



## 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

<b>Course Title: Introduction to Viticulture</b>		<b>Total Framework Hours: 180</b>
<b>CIP Code: 010309</b>	<input checked="" type="checkbox"/> <b>Exploratory</b> <input type="checkbox"/> <b>Preparatory</b>	<b>Date Last Modified: 2/23/2017</b>
<b>Career Cluster: Agriculture, Food, and Natural Resources</b>		<b>Cluster Pathway: Plant Systems</b>
<b>Eligible for Equivalent Credit in:</b> <input type="checkbox"/> <b>Math</b> <input checked="" type="checkbox"/> <b>Science</b>		<b>Total Number of Units: 8</b>

### 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).

<b>Unit 1: Introduction to Viticulture</b>	<b>Total Learning Hours for Unit: 20</b>
<p><b>Unit Summary:</b>  <b>This unit will introduce students to the history, purpose, science, and supply and demand of grape production, consumption, and processing.</b></p> <p>Competencies may include:</p> <ul style="list-style-type: none"> <li>• Asking questions by observing worldwide/US/WA production and consumption</li> <li>• Obtain, evaluate and communicate information utilizing basic supply and demand principles.</li> <li>• Identifying the species origin</li> <li>• Varieties in Washington – traditional or historic context</li> <li>• History of the vine from Mesopotamia to modern day.</li> </ul>	
<p><b>Performance Assessments:</b>  <i>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.</i></p> <p><i>It is expected that students will demonstrate understanding by:</i></p> <ul style="list-style-type: none"> <li>• Obtaining, evaluating, and communicating information by critically reading scientific and technical information related to grape production and basic supply and demand principles.</li> <li>• Communicate scientific information related to species origin and varieties grown in Washington through an oral or written presentation.</li> <li>• Viticulture Summative Project: comprehensive course long project: research varieties in Washington to determine preferred varieties.</li> </ul>	
<p><b>Leadership Alignment:</b></p> <p>Students will reason effectively and work independently to investigate the historical and current context of grape production.</p>	
<p><b><i>Industry Standards and Competencies</i></b></p>	
<p><b>Agriculture, Food, and Natural Resources (AFNR) Standards:</b></p> <p>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.).</p> <p>PS.02.01.02.b Identify and describe important plants to agricultural and ornamental plant systems by common names.</p> <p>PS.02.01.02.c Identify and describe important plants to agricultural and ornamental plant systems by scientific names.</p>	
<p><b><i>Aligned Washington State Standards</i></b></p>	
<p><b>Washington State Science Learning Standards (Next Generation Science Standards):</b></p> <p>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.</p>	

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 (C<sub>3</sub>, C<sub>4</sub>, 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 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.

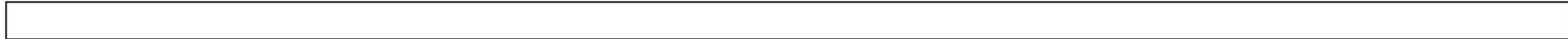
***Industry Standards and Competencies***

**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