



Agriculture and Natural Resources Industry Sector

Career Pathways

- ◆ Agricultural Business
- ◆ Agricultural Mechanics
- ◆ Agriscience
- ◆ Animal Science
- ◆ Forestry and Natural Resources
- ◆ Ornamental Horticulture
- ◆ Plant and Soil Science



Agriculture and Natural Resources Industry Sector

The Agriculture and Natural Resources sector is designed to provide a foundation in agriculture for all agriculture students in California. Students engage in an instructional program that integrates academic and technical preparation and focuses on career awareness, career exploration, and skill preparation in seven pathways. The pathways emphasize real-world, occupationally relevant experiences of significant scope and depth in Agricultural Business, Agricultural Mechanics, Agriscience, Animal Science, Forestry and Natural Resources, Ornamental Horticulture, and Plant and Soil Science. Integral components of classroom and laboratory instruction, supervised agricultural experience projects, and leadership and interpersonal skills development prepare students for continued training, advanced educational opportunities, or entry to a career.

FOUNDATION STANDARDS

1.0 Academics

Students understand the academic content required for entry into postsecondary education and employment in the Agriculture and Natural Resources sector.

(The standards listed below retain in parentheses the numbering as specified in the mathematics, science, and history–social science content standards adopted by the State Board of Education.)

1.1 Mathematics

Specific applications of Algebra I standards (grades eight through twelve):

- (10.0) Students add, subtract, multiply, and divide monomials and polynomials. Students solve multistep problems, including word problems, by using these techniques.
- (12.0) Students simplify fractions with polynomials in the numerator and denominator by factoring both and reducing them to the lowest terms.

- (13.0) Students add, subtract, multiply, and divide rational expressions and functions. Students solve both computationally and conceptually challenging problems by using these techniques.
- (15.0) Students apply algebraic techniques to solve rate problems, work problems, and percent mixture problems.

Specific applications of Geometry standards (grades eight through twelve):

- (8.0) Students know, derive, and solve problems involving the perimeter, circumference, area, volume, lateral area, and surface area of common geometric figures.
- (10.0) Students compute areas of polygons, including rectangles, scalene triangles, equilateral triangles, rhombi, parallelograms, and trapezoids.
- (11.0) Students determine how changes in dimensions affect the perimeter, area, and volume of common geometric figures and solids.
- (12.0) Students find and use measures of sides and of interior and exterior angles of triangles and polygons to classify figures and solve problems.

Specific applications of Probability and Statistics standards (grades eight through twelve):

- (8.0) Students organize and describe distributions of data by using a number of different methods, including frequency tables, histograms, standard line and bar graphs, stem-and-leaf displays, scatterplots, and box-and-whisker plots.

1.2 Science

Specific applications of Investigation and Experimentation standards (grades nine through twelve):

- (1.a) Select and use appropriate tools and technology (such as computer-linked probes, spreadsheets, and graphing calculators) to perform tests, collect data, analyze relationships, and display data.
- (1.c) Identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions.
- (1.d) Formulate explanations by using logic and evidence.
- (1.f) Distinguish between hypothesis and theory as scientific terms.
- (1.j) Recognize the issues of statistical variability and the need for controlled tests.
- (1.l) Analyze situations and solve problems that require combining and applying concepts from more than one area of science.
- (1.m) Investigate a science-based societal issue by researching the literature, analyzing data, and communicating the findings. Examples of issues include irradiation of food, cloning of animals by somatic cell nuclear transfer, choice of energy sources, and land and water use decisions in California.

1.3 History–Social Science

Specific applications of Principles of Economics standards (grade twelve):

- (12.2) Students analyze the elements of America’s market economy in a global setting.

- (12.2.2) Discuss the effects of changes in supply and/or demand on the relative scarcity, price, and quantity of particular products.
- (12.2.3) Explain the roles of property rights, competition, and profit in a market economy.
- (12.2.5) Understand the process by which competition among buyers and sellers determines a market price.
- (12.2.6) Describe the effect of price controls on buyers and sellers.
- (12.2.7) Analyze how domestic and international competition in a market economy affects goods and services produced and the quality, quantity, and price of those products.
- (12.2.10) Discuss the economic principles that guide the location of agricultural production and industry and the spatial distribution of transportation and retail facilities.
- (12.4) Students analyze the elements of the U.S. labor market in a global setting.
- (12.4.3) Discuss wage differences among jobs and professions, using the laws of demand and supply and the concept of productivity.

2.0 Communications

Students understand the principles of effective oral, written, and multimedia communication in a variety of formats and contexts.

(The standards listed below retain in parentheses the numbering as specified in the English–language arts content standards adopted by the State Board of Education.)

2.1 Reading

Specific applications of Reading Comprehension standards (grades nine and ten):

- (2.1) Analyze the structure and format of functional workplace documents, including the graphics and headers, and explain how authors use the features to achieve their purposes.
- (2.2) Prepare a bibliography of reference materials for a report using a variety of consumer, workplace, and public documents.
- (2.3) Generate relevant questions about readings on issues that can be researched.
- (2.6) Demonstrate use of sophisticated learning tools by following technical directions (e.g., those found with graphic calculators and specialized software programs and in access guides to World Wide Web sites on the Internet).
- (2.7) Critique the logic of functional documents by examining the sequence of information and procedures in anticipation of possible reader misunderstandings.
- (2.8) Evaluate the credibility of an author’s argument or defense of a claim by critiquing the relationship between generalizations and evidence, the comprehensiveness of evidence, and the way in which the author’s intent affects the structure and tone of the text (e.g., in professional journals, editorials, political speeches, primary source material).

Specific applications of Reading Comprehension standards (grades eleven and twelve):

- (2.1) Analyze both the features and the rhetorical devices of different types of public documents (e.g., policy statements, speeches, debates, platforms) and the way in which authors use those features and devices.
- (2.3) Verify and clarify facts presented in other types of expository texts by using a variety of consumer, workplace, and public documents.
- (2.4) Make warranted and reasonable assertions about the author's arguments by using elements of the text to defend and clarify interpretations.

2.2 Writing

Specific applications of Writing Strategies and Applications standards (grades nine and ten):

- (1.1) Establish a controlling impression or coherent thesis that conveys a clear and distinctive perspective on the subject and maintain a consistent tone and focus throughout the piece of writing.
- (1.2) Use precise language, action verbs, sensory details, appropriate modifiers, and the active rather than the passive voice.
- (1.3) Use clear research questions and suitable research methods (e.g., library, electronic media, personal interview) to elicit and present evidence from primary and secondary sources.
- (1.5) Synthesize information from multiple sources and identify complexities and discrepancies in the information and the different perspectives found in each medium (e.g., almanacs, microfiche, news sources, in-depth field studies, speeches, journals, technical documents).
- (2.3) Write expository compositions, including analytical essays and research reports:
 - a. Marshal evidence in support of a thesis and related claims, including information on all relevant perspectives.
 - b. Convey information and ideas from primary and secondary sources accurately and coherently.
 - c. Make distinctions between the relative value and significance of specific data, facts, and ideas.
 - d. Include visual aids by employing appropriate technology to organize and record information on charts, maps, and graphs.
 - e. Anticipate and address readers' potential misunderstandings, biases, and expectations.
 - f. Use technical terms and notations accurately.
- (2.5) Write business letters:
 - a. Provide clear and purposeful information and address the intended audience appropriately.
 - b. Use appropriate vocabulary, tone, and style to take into account the nature of the relationship with, and the knowledge and interests of, the recipients.
 - c. Highlight central ideas or images.

- d. Follow a conventional style with page formats, fonts, and spacing that contribute to the documents' readability and impact.
- (2.6) Write technical documents (e.g., a manual on rules of behavior for conflict resolution, procedures for conducting a meeting, minutes of a meeting):
 - a. Report information and convey ideas logically and correctly.
 - b. Offer detailed and accurate specifications.
 - c. Include scenarios, definitions, and examples to aid comprehension (e.g., troubleshooting guide).
 - d. Anticipate readers' problems, mistakes, and misunderstandings.

Specific applications of Writing Strategies and Applications standards (grades eleven and twelve):

- (1.3) Structure ideas and arguments in a sustained, persuasive, and sophisticated way and support them with precise and relevant examples.
- (1.6) Develop presentations by using clear research questions and creative and critical research strategies (e.g., field studies, oral histories, interviews, experiments, electronic sources).
- (1.7) Use systematic strategies to organize and record information (e.g., anecdotal scripting, annotated bibliographies).
- (1.8) Integrate databases, graphics, and spreadsheets into word-processed documents.
- (2.5) Write job applications and résumés:
 - a. Provide clear and purposeful information and address the intended audience appropriately.
 - b. Use varied levels, patterns, and types of language to achieve intended effects and aid comprehension.
 - c. Modify the tone to fit the purpose and audience.
 - d. Follow the conventional style for that type of document (e.g., résumé, memorandum) and use page formats, fonts, and spacing that contribute to the readability and impact of the document.
- (2.6) Deliver multimedia presentations:
 - a. Combine text, images, and sound and draw information from many sources (e.g., television broadcasts, videos, films, newspapers, magazines, CD-ROMs, the Internet, electronic media-generated images).
 - b. Select an appropriate medium for each element of the presentation.
 - c. Use the selected media skillfully, editing appropriately and monitoring for quality.
 - d. Test the audience's response and revise the presentation accordingly.

2.3 *Written and Oral English Language Conventions*

Specific applications of English Language Conventions standards (grades eleven and twelve):

- (1.1) Demonstrate control of grammar, diction, and paragraph and sentence structure and an understanding of English usage.

- (1.2) Produce legible work that shows accurate spelling and correct punctuation and capitalization.
- (1.3) Reflect appropriate manuscript requirements in writing.

2.4 *Listening and Speaking*

Specific applications of Listening and Speaking Strategies and Applications standards (grades nine and ten):

- (1.1) Formulate judgments about the ideas under discussion and support those judgments with convincing evidence.
- (1.7) Use props, visual aids, graphs, and electronic media to enhance the appeal and accuracy of presentations.
- (2.2) Deliver expository presentations:
 - a. Marshal evidence in support of a thesis and related claims, including information on all relevant perspectives.
 - b. Convey information and ideas from primary and secondary sources accurately and coherently.
 - c. Make distinctions between the relative value and significance of specific data, facts, and ideas.
 - d. Include visual aids by employing appropriate technology to organize and display information on charts, maps, and graphs.
 - e. Anticipate and address the listener's potential misunderstandings, biases, and expectations.
 - f. Use technical terms and notations accurately.
- (2.3) Apply appropriate interviewing techniques:
 - a. Prepare and ask relevant questions.
 - b. Make notes of responses.
 - c. Use language that conveys maturity, sensitivity, and respect.
 - d. Respond correctly and effectively to questions.
 - e. Demonstrate knowledge of the subject or organization.
 - f. Compile and report responses.
 - g. Evaluate the effectiveness of the interview.

Specific applications of Listening and Speaking Strategies and Applications standards (grades eleven and twelve):

- (1.8) Use effective and interesting language, including:
 - a. Informal expressions for effect
 - b. Standard American English for clarity
 - c. Technical language for specificity
- (1.14) Analyze the techniques used in media messages for a particular audience and evaluate their effectiveness (e.g., Orson Welles' radio broadcast "War of the Worlds").

- (2.4) Deliver multimedia presentations:
- a. Combine text, images, and sound by incorporating information from a wide range of media, including films, newspapers, magazines, CD-ROMs, online information, television, videos, and electronic media-generated images.
 - b. Select an appropriate medium for each element of the presentation.
 - c. Use the selected media skillfully, editing appropriately and monitoring for quality.
 - d. Test the audience's response and revise the presentation accordingly

3.0 Career Planning and Management

Students understand how to make effective decisions, use career information, and manage personal career plans:

- 3.1 Know the personal qualifications, interests, aptitudes, information, and skills necessary to succeed in careers.
- 3.2 Understand the scope of career opportunities and know the requirements for education, training, and licensure.
- 3.3 Develop a career plan that is designed to reflect career interests, pathways, and postsecondary options.
- 3.4 Understand the role and function of professional organizations, industry associations, and organized labor in a productive society.
- 3.5 Understand the past, present, and future trends that affect careers, such as technological developments and societal trends, and the resulting need for lifelong learning.
- 3.6 Know important strategies for self-promotion in the hiring process, such as job applications, résumé writing, interviewing skills, and preparation of a portfolio.

4.0 Technology

Students know how to use contemporary and emerging technological resources in diverse and changing personal, community, and workplace environments:

- 4.1 Understand past, present, and future technological advances as they relate to a chosen pathway.
- 4.2 Understand the use of technological resources to gain access to, manipulate, and produce information, products, and services.
- 4.3 Understand the influence of current and emerging technology on selected segments of the economy.
- 4.4 Understand geographic information systems (G.I.S.).
- 4.5 Determine the validity of the content and evaluate the authenticity, reliability, and bias of electronic and other resources.
- 4.6 Differentiate among, select, and apply appropriate tools and technology.

5.0 Problem Solving and Critical Thinking

Students understand how to create alternative solutions by using critical and creative thinking skills, such as logical reasoning, analytical thinking, and problem-solving techniques:

- 5.1 Apply appropriate problem-solving strategies and critical thinking skills to work-related issues and tasks.
- 5.2 Understand the systematic problem-solving models that incorporate input, process, outcome, and feedback components.
- 5.3 Use critical thinking skills to make informed decisions and solve problems.

6.0 Health and Safety

Students understand health and safety policies, procedures, regulations, and practices, including the use of equipment and handling of hazardous materials:

- 6.1 Know policies, procedures, and regulations regarding health and safety in the workplace, including employers' and employees' responsibilities.
- 6.2 Understand critical elements of health and safety practices related to storing, cleaning, and maintaining tools, equipment, and supplies.
- 6.3 Understand how to locate important information on a material safety data sheet.
- 6.4 Maintain safe and healthful working conditions.
- 6.5 Use tools and machines safely and appropriately.
- 6.6 Know how to both prevent and respond to accidents in the agricultural industry.

7.0 Responsibility and Flexibility

Students know the behaviors associated with the demonstration of responsibility and flexibility in personal, workplace, and community settings:

- 7.1 Understand the qualities and behaviors that constitute a positive and professional work demeanor.
- 7.2 Understand the importance of accountability and responsibility in fulfilling personal, community, and workplace roles.
- 7.3 Understand the need to adapt to varied roles and responsibilities.
- 7.4 Understand that individual actions can affect the larger community.
- 7.5 Understand the importance of time management to fulfill responsibilities.
- 7.6 Know how to apply high-quality craftsmanship to a product or presentation and continually refine and perfect it.

8.0 Ethics and Legal Responsibilities

Students understand professional, ethical, and legal behavior consistent with applicable laws, regulations, and organizational norms:

- 8.1 Know the major local, district, state, and federal regulatory agencies and entities that affect the industry and how they enforce laws and regulations.
- 8.2 Understand the concept and application of ethical and legal behavior consistent with workplace standards.
- 8.3 Understand the role of personal integrity and ethical behavior in the workplace.
- 8.4 Understand how to access, analyze, and implement quality assurance information.

9.0 Leadership and Teamwork

Students understand effective leadership styles, key concepts of group dynamics, team and individual decision making, the benefits of workforce diversity, and conflict resolution:

- 9.1 Understand the characteristics and benefits of teamwork, leadership, and citizenship in the school, community, and workplace settings.
- 9.2 Understand the ways in which preprofessional associations, such as the Future Farmers of America (FFA), and competitive career development activities enhance academic skills, promote career choices, and contribute to employability.
- 9.3 Understand how to organize and structure work individually and in teams for effective performance and the attainment of goals.
- 9.4 Know multiple approaches to conflict resolution and their appropriateness for a variety of situations in the workplace.
- 9.5 Understand how to interact with others in ways that demonstrate respect for individual and cultural differences and for the attitudes and feelings of others.
- 9.6 Understand leadership, cooperation, collaboration, and effective decision-making skills applied in group or team activities, including the student organization.

10.0 Technical Knowledge and Skills

Students understand the essential knowledge and skills common to all pathways in the Agriculture and Natural Resources sector:

- 10.1 Understand the aims, purposes, history, and structure of the FFA student organization, and know the opportunities it makes available.
- 10.2 Manage and actively engage in a career-related, supervised agricultural experience.

- 10.3 Understand the importance of maintaining and completing the California Agricultural Record Book.
- 10.4 Maintain and troubleshoot equipment used in the agricultural industry.

11.0 Demonstration and Application

Students demonstrate and apply the concepts contained in the foundation and pathway standards.

PATHWAY STANDARDS

A. Agricultural Business Pathway

In the Agricultural Business Pathway, students learn about agricultural business operation and management. Topics include accounting, finance, economics, business organization, marketing, and sales.

A1.0 Students understand decision-making processes within the American free enterprise system:

- A1.1 Differentiate among the components of the American free enterprise system and other forms of economic systems.
 - A1.2 Distinguish among the main characteristics of individual proprietorships, partnerships, corporations, and cooperatives.
 - A1.3 Understand the advantages and disadvantages of the four types of business ownership.
 - A1.4 Analyze appropriate decision-making tools and financial records to make key management decisions.
 - A1.5 Analyze physical production relationships to determine optimum use levels.
 - A1.6 Understand how to calculate the fixed and variable costs associated with the production of agricultural products and determine the output level that will yield maximum profit.
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A2.0 Students understand the fundamental economic principles of agribusiness and agricultural production:

- A2.1 Understand how basic economic factors affect agricultural production and agribusiness management decisions.
 - A2.2 Know basic agricultural economic terminology.
 - A2.3 Understand the law of supply and demand as it effects price determination.
 - A2.4 Analyze how agriculture uses scarce resources to meet the needs and demands of its consumers.
 - A2.5 Differentiate between elastic and inelastic supply and demand.
 - A2.6 Understand the law of diminishing returns and its impact on agricultural production.
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A3.0 Students understand the role of credit in agribusiness and agricultural production:

- A3.1 Analyze the factors that determine the cost of credit in order to select optimum credit sources (e.g., the advantages and disadvantages of borrowing from the various types of credit providers and sources for short-, intermediate-, and long-term credit).
- A3.2 Know the criteria lenders use to evaluate repayment capacity.
- A3.3 Analyze balance sheets and cash-flow statements to determine the ability to repay loans.

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- A4.0 Students understand proper accounting principles and procedures used in business management and tax planning:*
- A4.1 Understand the differences between cash and accrual accounting systems.
 - A4.2 Understand the use and importance of budgets, income statements, balance sheets, and financial statements.
 - A4.3 Understand the basis of taxation within the tax system and its impact on the economy, including the role of taxes in agribusiness.
 - A4.4 Analyze the role of depreciation and purchasing in tax planning and liability.
 - A4.5 Understand how to determine property values and how to complete a depreciation schedule.
 - A4.6 Understand how to determine the tax obligations for an agribusiness.
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- A5.0 Students understand basic risk management principles and their impact on economic viability:*
- A5.1 Understand environmental responsibility and its impact on agribusiness.
 - A5.2 Understand the concept of liability and the economic impact of being held liable.
 - A5.3 Understand the concept and process of risk management, including the use of risk management tools such as insurance.
 - A5.4 Understand how recordkeeping, farm plans, and an analysis of best practices affect risk management decisions.
 - A5.5 Understand the role of contingency plans in risk management.
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- A6.0 Students understand the role and value of agricultural organizations:*
- A6.1 Understand the benefits of private, public, and governmental organizations, including the value and impact of cooperatives.
 - A6.2 Understand how participation within organizations would be beneficial in supporting various agricultural operations.
 - A6.3 Understand how to identify and electronically access public and private agricultural organizations.
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- A7.0 Students understand agricultural marketing systems:*
- A7.1 Understand how marketing functions in a free market society.
 - A7.2 Understand the advantages and disadvantages of the various marketing options for agricultural products and services.
 - A7.3 Understand how the law of comparative advantage affects agricultural production.
 - A7.4 Understand the impact of advertising and promotion on the marketing of agricultural products and services.
 - A7.5 Understand how promotion trends for agricultural products influence individuals.
 - A7.6 Understand how to develop a marketing plan for an agricultural product or service.

A8.0 Students understand the sales of agricultural products and services:

- A8.1 Determine the most effective methods for assessing customer needs and wants.
- A8.2 Understand the stages in making a successful sale and the various techniques used to approach potential customers and overcome their objections.
- A8.3 Examine the physiological and psychological factors that influence motivation to purchase, including the fundamental steps in making a purchase.

A9.0 Students understand local, national, and international agricultural markets and how trade affects the economy:

- A9.1 Understand how the importance of agricultural imports and exports affects state and national economies.
- A9.2 Know how governmental, economic, and cultural factors affect international trade.
- A9.3 Compare and contrast United States trade policies with those of other important trading partners.
- A9.4 Understand how biotechnology affects trade and global economies.
- A9.5 Understand how different cultural values affect agricultural production and marketing.
- A9.6 Understand how negotiations and bargaining agreements affect trade agreements.
- A9.7 Analyze agricultural marketing strategies in other parts of the world.

B. Agricultural Mechanics Pathway

The Agricultural Mechanics Pathway prepares students for careers related to the construction, operation, and maintenance of equipment used by the agriculture industry. Basic agricultural mechanics skills and safety, standards B1.0 through B8.0, cover woodworking, electrical systems, plumbing, cold metal work, concrete, and welding technology. Advanced topics, standards B9.0 through B12.0, deal with metal fabrication, small engines, agriculture power and technology, and agriculture construction.

B1.0 Students understand personal and group safety:

- B1.1 Practice the rules for personal and group safety while working in an agricultural mechanics environment.
 - B1.2 Know the relationship between accepted shop management procedures and a safe working environment.
 - B1.3 Know how to safely secure loads on a variety of vehicles.
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B2.0 Students understand the principles of basic woodworking:

- B2.1 Know how to identify common wood products, lumber types, and sizes.
 - B2.2 Know how to calculate board feet, lumber volume, and square feet.
 - B2.3 Know how to identify, select, and implement basic fastening systems.
 - B2.4 Complete a woodworking project, including interpreting a plan, developing a bill of materials and cutting list, selecting materials, shaping, joining, and finishing.
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B3.0 Students understand the basic electricity principles and wiring practices commonly used in agriculture:

- B3.1 Understand the relationship between voltage, amperage, resistance, and power in single-phase alternating current (AC) circuits.
 - B3.2 Know how to use proper electrical test equipment for AC and direct current (DC).
 - B3.3 Analyze and correct basic circuit problems (e.g., open circuits, short circuits, incorrect grounding).
 - B3.4 Understand proper basic electrical circuit and wiring techniques with nonmetallic cable and conduit as defined by the National Electric Code.
 - B3.5 Interpret basic agricultural electrical plans.
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B4.0 Students understand plumbing system practices commonly used in agriculture:

- B4.1 Know basic plumbing fitting skills with a variety of materials, such as copper, PVC (polyvinyl chloride), steel, polyethylene, and ABS (acrylonitrile butadiene styrene).
- B4.2 Understand the environmental influences on plumbing system choices (e.g., filter systems, water disposal).

- B4.3 Know how various plumbing and irrigation systems are used in agriculture.
- B4.4 Complete a plumbing project, including interpreting a plan, developing a bill of materials and cutting list, selecting materials, joining, and testing.

B5.0 Students understand agricultural cold metal processes:

- B5.1 Know how to identify common metals, sizes, and shapes.
- B5.2 Know basic tool-fitting skills.
- B5.3 Know layout skills.
- B5.4 Know basic cold metal processes (e.g., shearing, cutting, drilling, threading, bending.).
- B5.5 Complete a cold metal project, including interpreting a plan, developing a bill of materials, selecting materials, shaping, fastening, and finishing.

B6.0 Students understand concrete and masonry practices commonly used in agriculture:

- B6.1 Understand how to accurately calculate volume, materials needed, and project costs for a concrete or masonry project.
- B6.2 Know proper bed preparation, concrete forms layout, and construction.
- B6.3 Complete a concrete or masonry project, including developing a bill of materials, assembling, mixing, placing, and finishing.

B7.0 Students understand oxy-fuel cutting and welding:

- B7.1 Understand the role of heat and oxidation in the cutting process.
- B7.2 Know how to properly set up, adjust, shut down, and maintain an oxy-fuel system.
- B7.3 Know how to flame-cut metal with an oxy-fuel cutting torch.
- B7.4 Know how to fusion-weld mild steel with and without filler rod by using oxy-fuel equipment.
- B7.5 Know basic repair skills using a variety of techniques, such as brazing or hard surfacing.

B8.0 Students understand electric arc welding processes:

- B8.1 Know how to select, properly adjust, safely employ, and maintain appropriate welding equipment (e.g., gas metal arc welding, shielded metal arc welding, gas tungsten arc welding).
- B8.2 Apply gas metal arc welding, shielded metal arc welding, or flux core arc welding processes to fusion-weld mild steel with appropriate welding electrodes and related equipment.
- B8.3 Weld a variety of joints in various positions.
- B8.4 Know how to read welding symbols and plans, select electrodes, fit-up joints, and control heat and distortion.

B9.0 Students understand advanced metallurgy principles and fabrication techniques:

- B9.1 Understand metallurgy principles, including distortion, hardening, tempering, and annealing.
- B9.2 Operate and maintain various arc welding and cutting systems safely and appropriately.
- B9.3 Operate and maintain fabrication tools and equipment safely and appropriately.
- B9.4 Understand how to design project plans by using mechanical drawing techniques.
- B9.5 Understand how to finish a metal project by implementing proper sequencing.
- B9.6 Know how to manipulate and finish metal by using a variety of machines and techniques (e.g., lathe, mill, CNC plasma, shears, press break).
- B9.7 Construct a welding project (using any electric welding process, appropriate products, joints, and positions), including interpreting a plan, developing a bill of materials, selecting materials, and developing a clear and concise fabrication contract.

B10.0 Students understand small and compact engines:

- B10.1 Understand engine theory for both two- and four-stroke cycle engines.
- B10.2 Know different types of small engines and their applications.
- B10.3 Know small engine parts and explain the various systems (e.g., fuel, ignition, compression, cooling, lubrication systems).
- B10.4 Know how to troubleshoot and solve problems with small engines.
- B10.5 Know how to disassemble, inspect, adjust, and reassemble a small engine.
- B10.6 Know how to look up parts, apply repair and maintenance recommendations from a repair manual, and complete appropriate forms, including work orders.

B11.0 Students understand the principles and applications of various engines and machinery used in agriculture:

- B11.1 Understand how to identify common agricultural machinery.
- B11.2 Operate and maintain equipment safely and efficiently.
- B11.3 Know the various types of engines found on agricultural machinery and understand the theory and safe operation of their systems (e.g., cooling, electrical, fuel).
- B11.4 Know the theory and operation of mobile hydraulic systems and power take-off systems.
- B11.5 Troubleshoot common problems with engines and agricultural equipment.
- B11.6 Understand the theory and operation of 12-volt DC electronic and electrical systems (e.g., circuit design, starting, charging, and safety circuits).

B12.0 Students understand land measurement and construction techniques commonly used in agriculture:

- B12.1 Understand common surveying techniques used in agriculture (e.g., leveling, land measurement, building layout).
- B12.2 Know how to draw and interpret architectural plans.
- B12.3 Know how to install single- and three-phase wiring and control systems found in agricultural structures, pumps, and irrigation systems.
- B12.4 Install plumbing in agricultural structures (e.g., potable water, sewer, irrigation).
- B12.5 Form, place, and finish concrete or masonry (e.g., concrete block).
- B12.6 Understand how to construct agricultural structures by using wood framing and steel framing systems (e.g., barns, shops, greenhouses, animal structures).
- B12.7 Develop clear and concise agricultural construction contracts.

C. Agriscience Pathway

The Agriscience Pathway helps students acquire a broad understanding of a variety of agricultural areas, develop an awareness of the many career opportunities in agriculture, participate in occupationally relevant experiences, and work cooperatively with a group to develop and expand leadership abilities. Students study California agriculture, agricultural business, agricultural technologies, natural resources, and animal, plant, and soil sciences.

C1.0 Students understand the role of agriculture in the California economy:

- C1.1 Understand the history of the agricultural industry in California.
 - C1.2 Understand how California agriculture affects the quality of life.
 - C1.3 Understand the interrelationship of California agriculture and society at the local, state, national, and international levels.
 - C1.4 Understand the economic impact of leading California agricultural commodities.
 - C1.5 Understand the economic impact of major natural resources in California.
 - C1.6 Know the economic importance of major agricultural exports and imports.
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C2.0 Students understand the interrelationship between agriculture and the environment:

- C2.1 Understand important agricultural environmental impacts on soil, water, and air.
 - C2.2 Understand current agricultural environmental challenges.
 - C2.3 Understand how natural resources are used in agriculture.
 - C2.4 Compare and contrast practices for conserving renewable and nonrenewable resources.
 - C2.5 Understand how new energy sources are developed from agricultural products (e.g., gas-cogeneration and ethanol).
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C3.0 Students understand the effects of technology on agriculture:

- C3.1 Understand how an agricultural commodity moves from producer to consumer.
 - C3.2 Understand how technology influences factors such as labor, efficiency, diversity, availability, mechanization, communication, and so forth.
 - C3.3 Understand public concern for technological advancements in agriculture, such as genetically modified organisms.
 - C3.4 Understand the laws and regulations concerning biotechnology.
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C4.0 Students understand the importance of animals, the domestication of animals, and the role of animals in modern society:

- C4.1 Understand the evolution and roles of domesticated animals in society.
- C4.2 Know the differences between domestication and natural selection.
- C4.3 Understand the modern-day uses of animals and animal by-products.

- C4.4 Understand various points of view regarding the use of animals.
- C4.5 Understand unique and alternative uses of animals (e.g., Handi-Riders and companion animals).

C5.0 Students understand the cell structure and function of plants and animals:

- C5.1 Understand the purpose and anatomy of cells.
- C5.2 Know how cell parts function.
- C5.3 Understand various cell actions, such as osmosis and cell division.
- C5.4 Understand how plant and animal cells are alike and different.

C6.0 Students understand animal anatomy and systems:

- C6.1 Know the names and locations of the external anatomy of animals.
- C6.2 Know the anatomy and major functions of vertebrate systems, including digestive, reproductive, circulatory, nervous, muscular, skeletal, respiratory, and endocrine systems.

C7.0 Students understand basic animal genetics:

- C7.1 Differentiate between genotype and phenotype, and describe how dominant and recessive genes function.
- C7.2 Compare genetic characteristics among cattle, sheep, swine, and horse breeds.
- C7.3 Understand how to display phenotype and genotype ratios (e.g., by using a Punnett Square).
- C7.4 Understand the fertilization process.
- C7.5 Understand the purpose and processes of mitosis and meiosis.

C8.0 Students understand fundamental animal nutrition and feeding:

- C8.1 Know types of nutrients required by farm animals (e.g., proteins, minerals, vitamins, carbohydrates, fats/oils, water).
- C8.2 Analyze suitable common feed ingredients, including forages, roughages, concentrates, and supplements, for ruminant, monogastric, equine, and avian digestive systems.
- C8.3 Understand basic animal feeding guidelines and evaluate sample feeding programs for various species, including space requirements and economic considerations.

C9.0 Students understand basic animal health:

- C9.1 Assess the appearance and behavior of a normal, healthy animal.
- C9.2 Understand the ways in which housing, sanitation, and nutrition influence animal health and behavior.
- C9.3 Understand the causes and control of common animal diseases.

- C9.4 Understand how to control parasites and why.
 - C9.5 Understand the legal requirements for the procurement, storage, methods of application, and withdrawal times of animal medications and know proper equipment handling and disposal techniques.
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C10.0 Students understand soil science principles:

- C10.1 Recognize the major soil components and types.
 - C10.2 Understand how soil texture, structure, pH, and salinity affect plant growth.
 - C10.3 Understand water delivery and irrigation system options.
 - C10.4 Understand the types, uses, and applications of amendments and fertilizers.
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C11.0 Students understand plant growth and development:

- C11.1 Understand the anatomy and functions of plant systems and structures.
 - C11.2 Understand plant growth requirements.
 - C11.3 Know annual, biennial, and perennial life cycles.
 - C11.4 Examine plant sexual and asexual reproduction.
 - C11.5 Understand the photosynthesis process and the roles of the sun, chlorophyll, sugar, oxygen, carbon dioxide, and water in the process.
 - C11.6 Understand the respiration process in the breakdown of food and organic matter.
-

C12.0 Students understand fundamental pest management:

- C12.1 Understand the major classifications of pests (e.g., insects, weeds, disease, vertebrate pests).
 - C12.2 Understand chemical, mechanical, cultural, and biological methods of plant pest control.
 - C12.3 Understand the major principles, advantages, and disadvantages of integrated pest management.
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C13.0 Students understand the scientific method:

- C13.1 Understand the steps of the scientific method.
- C13.2 Analyze an animal or plant problem and devise a solution based on the scientific method.
- C13.3 Use the scientific method to conduct agricultural experiments.

D. Animal Science Pathway

In the Animal Science Pathway, students study large, small, and specialty animals. Students explore the necessary elements—such as diet, genetics, habitat, and behavior—to create humane, ecologically and economically sustainable animal production systems. The pathway includes the study of animal anatomy and physiology, nutrition, reproduction, genetics, health and welfare, animal production, technology, and the management and processing of animal products and by-products.

D1.0 Students understand the necessary elements for proper animal housing and animal-handling equipment:

- D1.1 Understand appropriate space and location requirements for habitat, housing, feed, and water.
 - D1.2 Understand how to select habitat and housing conditions and materials (such as indoor and outdoor housing, fencing materials, air flow/ventilation, and shelters) to meet the needs of various animal species.
 - D1.3 Understand the purpose and the safe and humane use of restraint equipment, such as squeeze chutes, halters, and twitches.
 - D1.4 Understand the purpose and the safe and humane use of animal husbandry tools, such as hoof trimmers, electric shears, elastrators, dehorning tools, and scales.
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D2.0 Students understand key principles of animal nutrition:

- D2.1 Understand the flow of nutrients from the soil, through the animal, and back to the soil.
 - D2.2 Understand the principles for providing proper balanced rations for a variety of production stages in ruminants and monogastrics.
 - D2.3 Understand the digestive processes of the ruminant, monogastric, avian, and equine digestive systems.
 - D2.4 Understand how animal nutrition is affected by the digestive, endocrine, and circulatory systems.
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D3.0 Students understand animal physiology:

- D3.1 Understand the major physiological systems and the function of the organs within each system.
- D3.2 Understand the animal management practices that are likely to improve the functioning of the various physiological systems.

D4.0 Students understand animal reproduction, including the function of reproductive organs:

- D4.1 Understand animal conception (including estrus cycles, ovulation, and insemination).
- D4.2 Understand the gestation process and basic fetal development.
- D4.3 Understand the parturition process, including the identification of potential problems and their solutions.
- D4.4 Understand the role of artificial insemination and embryo transfer in animal agriculture.
- D4.5 Understand commonly used animal production breeding systems (e.g., purebred compared with crossbred) and reasons for their use.

D5.0 Students understand animal inheritance and selection principles, including the structure and role of DNA:

- D5.1 Evaluate a group of animals for desired qualities and discern among them for breeding selection.
- D5.2 Understand how to use animal performance data in the selection and management of production animals.
- D5.3 Research and discuss current technology used to measure desirable traits.
- D5.4 Understand how to predict phenotypic and genotypic results of a dominant and recessive gene pair.
- D5.5 Understand the role of mutations (both naturally occurring and artificially induced) and hybrids in animal genetics.

D6.0 Students understand the causes and effects of diseases and illnesses in animals:

- D6.1 Understand the signs of normal health in contrast to illness and disease.
- D6.2 Understand the importance of animal behavior in diagnosing animal sickness and disease.
- D6.3 Understand the common pathogens, vectors, and hosts that cause disease in animals.
- D6.4 Understand prevention, control, and treatment practices related to pests and parasites.
- D6.5 Apply quality assurance practices to the proper administration of medicines and animal handling.
- D6.6 Understand how diseases are passed among animal species and from animals to humans and how that relationship affects health and food safety.
- D6.7 Understand the impacts on local, national, and global economies as well as on consumers and producers when animal diseases are not appropriately contained and eradicated.

D7.0 Students understand common rangeland management practices and their impact on a balanced ecosystem:

- D7.1 Understand the role of rangeland use in an effective animal production program.
- D7.2 Know how rangeland management practices affect pasture production, erosion control, and the general balance of the ecosystem.
- D7.3 Understand how to manage rangelands (including how to calculate carrying capacity) for a variety of animal species and locations.
- D7.4 Understand how to balance rangeland use for animal grazing and for wildlife habitat.

D8.0 Students understand the challenges associated with animal waste management:

- D8.1 Understand animal waste treatment and disposal management systems.
- D8.2 Understand various methods for using animal waste and their environmental impacts.
- D8.3 Understand the health and safety regulations that are an integral part of properly managed animal waste systems.

D9.0 Students understand animal welfare concerns and management practices that support animal welfare:

- D9.1 Know the early warning signs of animal distress and how to rectify the problem.
- D9.2 Understand public concerns for animal welfare in the context of housing, behavior, nutrition, transportation, disposal, and harvest of animals.
- D9.3 Understand federal and state animal welfare laws and regulations, such as those dealing with abandoned and neglected animals, animal fighting, euthanasia, and medical research.
- D9.4 Understand the regulations for humane transport and harvest of animals, such as those delineated by the U.S. Department of Agriculture, Food Safety and Inspection Service, and the Humane Methods of Slaughter Act.

D10.0 Students understand the production of large animals (e.g., cattle, horses, swine, sheep, goats) and small animals (e.g., poultry, cavy, rabbits):

- D10.1 Know how to synthesize and implement optimum requirements for diet, genetics, habitat, and behavior in the production of large and small animals.
- D10.2 Understand how to develop, maintain, and use growth and management records for large or small animals.

D11.0 Students understand the production of specialty animals (e.g., fish, marine animals, llamas, tall flightless birds):

- D11.1 Understand the specialty animal's role in agriculture (e.g., fish farms, pack animals, working dogs).
- D11.2 Understand the unique nutrition, health, and habitat requirements for specialty animals.
- D11.3 Know how to synthesize and implement optimum requirements for diet, genetics, habitat, and behavior in the production of specialty animals.
- D11.4 Understand how to develop, maintain, and use growth and management records for specialty animals.

D12.0 Students understand how animal products and by-products are processed and marketed:

- D12.1 Understand animal harvest, carcass inspection and grading, and meat processing safety regulations and practices and the removal and disposal of nonedible by-products, such as those outlined in Hazard Analysis and Critical Control Point documents.
- D12.2 Understand the relative importance of the major meat classifications, including the per capita consumption and nutritive value of those classifications.
- D12.3 Understand how meat-based products and meals are made.
- D12.4 Understand how nonmeat products (such as eggs, wool, pelts, hides, and by-products) are harvested and processed.
- D12.5 Understand how meat products and nonmeat products are marketed.
- D12.6 Understand the value of animal by-products to nonagricultural industries.

E. Forestry and Natural Resources Pathway

The Forestry and Natural Resources Pathway helps students understand the relationships between California's natural resources and the environment. Topics include energy and nutrient cycles, water resources and management, soil conservation, wild-life preservation and management, forest and fire management, and lumber production. In addition, students study the outdoor recreation industry and multiple-use management.

E1.0 Students understand the importance of energy and energy cycles:

- E1.1 Understand the oxygen, carbon, nitrogen, and water cycles.
 - E1.2 Understand the difference between renewable and nonrenewable energy sources.
 - E1.3 Understand the difference between natural resource management conservation strategies and preservation strategies.
 - E1.4 Compare the effects on air and water quality of using different forms of energy.
 - E1.5 Analyze the way in which human activities influence energy cycles and natural resource management.
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E2.0 Students understand air and water use, management practices, and conservation strategies:

- E2.1 Understand the government's role in regulating air, soil, and water use management practices and conservation strategies.
 - E2.2 Understand air and water conservation issues.
 - E2.3 Understand appropriate water conservation measures.
 - E2.4 Understand the component of a plan that monitors water quality.
 - E2.5 Understand the component of a plan that monitors air quality.
 - E2.6 Analyze the way in which water management affects the environment and human needs.
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E3.0 Students understand soil composition and soil management:

- E3.1 Understand the systems used to classify soils.
- E3.2 Understand the reasons for and importance of soil conservation.
- E3.3 Understand how to analyze soils found in the different natural resource management areas.
- E3.4 Understand how to develop and implement a soil management plan for a natural resource management area.
- E3.5 Understand how to analyze existing soil surveys to develop effective management plans.

E4.0 Students understand rangeland management:

- E4.1 Know the locations of major U.S. and California rangeland areas.
- E4.2 Understand the interrelationship of rangeland management, the environment, wildlife management, and the livestock industry.
- E4.3 Understand practices used to improve rangeland quality.
- E4.4 Analyze the carrying capacity in various rangelands for both wildlife species and domestic livestock.
- E4.5 Distinguish among different browse and forage species in California rangelands.
- E4.6 Understand the components of a rangeland monitoring plan.
- E4.7 Understand the requirements and rights accompanying public land grazing permits and the government agencies involved (e.g., Bureau of Land Management and U.S. Forest Service).

E5.0 Students understand wildlife management and habitat:

- E5.1 Understand the relationship between habitat and wildlife population.
- E5.2 Understand habitat requirements for different species and identify factors that influence population dynamics.
- E5.3 Understand the methods for determining existing wildlife species populations.
- E5.4 Understand mammalian and avian reproductive processes and explain how nutrition and habitat affect reproduction and population.
- E5.5 Understand a variety of management practices used to manage wildlife populations for hunting and other recreational purposes.
- E5.6 Analyze the economic and environmental significance of sport hunting and fishing industries.
- E5.7 Understand the purpose, history, terminology, and challenges of the Endangered Species Act and current activities related to the Act.

E6.0 Students understand aquatic resource use and management:

- E6.1 Understand the different types of aquatic resources.
- E6.2 Know the major body parts, digestive systems, and reproductive organs of aquatic species.
- E6.3 Understand a variety of methods to determine the populations of existing aquatic species.
- E6.4 Analyze the relationship between water quality and aquatic species habitat.
- E6.5 Understand a variety of management practices for managing aquatic species for sport fishing and other purposes.
- E6.6 Understand how to make financial and production decisions and maintain growth and management records for a selected aquatic species.

E7.0 Students understand the outdoor recreation industry:

- E7.1 Understand the potential environmental impacts of recreational activities and how to manage the resources affected.
- E7.2 Understand basic survival skills and first-aid procedures.
- E7.3 Understand appropriate trail construction and maintenance techniques.
- E7.4 Understand how to select appropriate recreational gear for trips of varying types and durations and how to use it safely and appropriately (for minimum environmental impact).
- E7.5 Know how to set up a campsite for minimum environmental impact.

E8.0 Students understand basic plant physiology, anatomy, and taxonomy:

- E8.1 Understand the scientific method of animal classification, including order, family, genus, and species.
- E8.2 Know how to use a dichotomous key to identify plants and animals.
- E8.3 Know how to identify local trees, shrubs, grasses, forbs, and wildlife species by common name.
- E8.4 Recognize the factors that influence plant growth, such as respiration, temperature, nutrients, and photosynthesis.

E9.0 Students understand the role of fire in natural resource management:

- E9.1 Understand the role of fire in forest and rangeland ecosystems.
- E9.2 Understand the significance of each of the components of the “fire triangle.”
- E9.3 Know appropriate wildland fire-suppression practices.
- E9.4 Understand the components of a fire-control plan.
- E9.5 Know how to use fire-control tools safely.
- E9.6 Know the training requirements for fire-suppression certification.

E10.0 Students understand forest management practices:

- E10.1 Understand how social, political, and economic factors can affect the use of forests.
- E10.2 Understand the California Forest Practice Act and the requirements for Timber Harvest and Habitat Conservation Plans.
- E10.3 Analyze forest management systems (e.g., sustained yield, watershed management, ecosystem management, multiple-use management).
- E10.4 Analyze harvest and renewability (e.g., re-seeding and thinning) systems and identify the impact of each on the land.
- E10.5 Understand Silvicultural systems and skills, including appropriate tool use.
- E10.6 Understand how to identify and diagnose damage from destructive insects, diseases, and weather, and know methods for their management.

E11.0 Students understand the basic concepts of measurement, surveying, and mapping:

- E11.1 Understand the Public Land Survey System.
- E11.2 Use surveying equipment, including global positioning satellites, maps, and a compass to determine area, boundaries, and elevation differences.
- E11.3 Know how to apply timber-cruising and log-scaling skills to determine timber and log volume for management and marketing.
- E11.4 Understand how to create a management plan map that includes layer information and data points from global information systems.

E12.0 Students understand the use, processing, and marketing of products from natural resource industries:

- E12.1 Know the marketing processes and manufacturing standards for a variety of natural resource products, including mining, quarrying, and drilling.
- E12.2 Know how to manufacture a product (to manufacturing standards) from a natural resource.
- E12.3 Analyze the production of specialty and seasonal products from natural resources.
- E12.4 Know different wood types and their uses.
- E12.5 Know lumber manufacturing processes.

E13.0 Students understand public and private land issues:

- E13.1 Understand the differences between publicly and privately held lands.
- E13.2 Understand the differences between public land designations (e.g., State Park, National Forest, wilderness areas, wild and scenic areas).
- E13.3 Understand the role of public and private property rights and how they affect agriculture.
- E13.4 Understand the role of government in managing public and private property rights.

F. Ornamental Horticulture Pathway

The Ornamental Horticulture Pathway prepares students for careers in the nursery, landscaping, and floral industries. Topics include plant identification, plant physiology, soil science, plant reproduction, nursery production, and floriculture as well as landscaping design, installation, and maintenance.

F1.0 Students understand plant classification and use principles:

- F1.1 Understand how to classify and identify plants by order, family, genus, and species.
 - F1.2 Understand how to identify plants by using a dichotomous key.
 - F1.3 Understand how common plant parts are used to classify the plants.
 - F1.4 Understand how to classify and identify plants by using botanical growth habits, landscape uses, and cultural requirements.
 - F1.5 Understand plant selection and identification for local landscape applications.
-

F2.0 Students understand plant physiology and growth principles:

- F2.1 Understand plant systems, nutrient transportation, structure, and energy storage.
 - F2.2 Understand the seed's essential parts and functions.
 - F2.3 Understand how primary, secondary, and trace elements are used in plant growth.
 - F2.4 Understand the factors that influence plant growth, including water, nutrients, light, soil, air, and climate.
 - F2.5 Understand the tissues seen in a cross section of woody and herbaceous plants.
 - F2.6 Understand the factors that affect plant growth.
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F3.0 Students understand sexual and asexual plant reproduction:

- F3.1 Understand the different forms of sexual and asexual plant reproduction.
 - F3.2 Understand the various techniques for successful plant propagation (e.g., budding, grafting, cuttings, seeds).
 - F3.3 Understand how to monitor plant reproduction for the development of a saleable product.
-

F4.0 Students understand basic integrated pest management principles:

- F4.1 Read and interpret pesticide labels and understand safe pesticide management practices.
- F4.2 Understand how pesticide regulations and government agencies affect agriculture.
- F4.3 Understand common horticultural pests and diseases and methods of controlling them.
- F4.4 Understand the systematic approach to solving plant problems.

F5.0 Students understand water and soil (media) management practices:

- F5.1 Understand how basic soil science and water principles affect plant growth.
- F5.2 Know basic irrigation design and installation methods.
- F5.3 Prepare and amend soils, implement soil conservation methods, and compare results.
- F5.4 Understand major issues related to water sources and water quality.
- F5.5 Know the components of soilless media and the use of those media in various types of containers.

F6.0 Students understand ornamental plant nutrition practices:

- F6.1 Analyze how primary and secondary nutrients and trace elements affect ornamental plants.
- F6.2 Understand basic nutrient testing procedures on soil and plant tissue.
- F6.3 Analyze organic and inorganic fertilizers to understand their appropriate uses.
- F6.4 Understand how to read and interpret labels to properly apply fertilizers.

F7.0 Students understand the selection, installation, and maintenance of turf:

- F7.1 Understand the selection and management of landscape and sports field turf.
- F7.2 Understand how to select, install, and maintain a designated turfgrass area.
- F7.3 Understand how the use of turf benefits the environment.

F8.0 Students understand nursery production principles:

- F8.1 Understand how to properly use production facilities and common nursery equipment.
- F8.2 Understand common nursery production practices.
- F8.3 Understand how to propagate and maintain a horticultural crop to the point of sale.
- F8.4 Understand marketing and merchandising principles used in nursery production.

F9.0 Students understand the use of containers and horticultural tools, equipment, and facilities:

- F9.1 Understand the use of different types of containers and demonstrate how to maintain growing containers in controlled environments.
- F9.2 Operate and maintain selected hand and power equipment safely and appropriately.
- F9.3 Select proper tools for specific horticultural jobs.
- F9.4 Understand how to install landscape components and electrical land and water features.

F10.0 Students understand basic landscape planning, design, construction, and maintenance:

- F10.1 Know the terms associated with landscape and design and their appropriate use.
- F10.2 Understand the principles of residential design, including how to render design to scale.
- F10.3 Understand proper landscape planting and maintenance practices.
- F10.4 Prune ornamental shrubs, trees, and fruit trees.
- F10.5 Develop clear and concise landscape business contracts.

F11.0 Students understand basic floral design principles:

- F11.1 Understand the use of plant materials and tools.
- F11.2 Apply basic design principles to products and designs.
- F11.3 Handle, prepare, and arrange cut flowers appropriately.
- F11.4 Understand marketing and merchandising principles used in the floral industry.

G. Plant and Soil Science Pathway

The Plant and Soil Science Pathway covers topics such as plant classification, physiology, reproduction, plant breeding, biotechnology, and pathology. In addition, students learn about soil management, water, pests, and equipment as well as cultural and harvest practices.

G1.0 Students understand plant classification principles:

- G1.1 Understand how to classify and identify plants by order, family, genus, and species.
 - G1.2 Understand how to identify plants by using a dichotomous key.
 - G1.3 Understand how common plant parts are used to classify the plants.
 - G1.4 Understand the differences between and uses of native and nonnative plants.
 - G1.5 Understand the differences between monocots and dicots.
 - G1.6 Understand the differences between plants under production and weeds.
-

G2.0 Students understand cell biology:

- G2.1 Understand the differences between prokaryotic cells and plant and animal eukaryotic cells and how viruses differ from them in complexity and general structure.
 - G2.2 Understand plant cellular function reactions when plants are grown under different conditions.
 - G2.3 Understand what functions organelles play in the health of the cell.
 - G2.4 Understand the part of the cell that is responsible for the genetic information that controls plant growth and development.
 - G2.5 Understand plant inheritance principles, including the structure and role of DNA.
 - G2.6 Understand which organelles in plant cells carry out photosynthesis.
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G3.0 Students understand plant physiology and growth principles:

- G3.1 Understand plant systems, nutrient transportation, structure, and energy storage.
- G3.2 Understand the seed's essential parts and functions.
- G3.3 Understand how primary, secondary, and trace elements are used in plant growth.
- G3.4 Understand the factors that influence plant growth, including water, nutrients, light, soil, air, and climate.
- G3.5 Understand the tissues seen in a cross section of woody and herbaceous plants.
- G3.6 Understand the factors that affect plant growth and predict plant response.

G4.0 Students understand sexual and asexual reproduction of plants:

- G4.1 Understand the different forms of sexual and asexual plant reproduction.
- G4.2 Understand the various techniques for successful plant propagation (e.g., budding, grafting, cuttings, and seeds).
- G4.3 Understand the proper sterile technique used in tissue culture.

G5.0 Students understand pest problems and management:

- G5.1 Understand how to categorize insects as pests, beneficial, or neutral and their roles.
- G5.2 Understand the role of other pests, such as nematodes, molds, mildews, and weeds.
- G5.3 Know conventional, sustainable, and organic management methods to prevent or treat plant disease symptoms.
- G5.4 Understand integrated pest management to prevent, treat, and control plant disease symptoms (including conventional, sustainable, and organic management methods).
- G5.5 Understand how biotechnology can be used to manage pests.

G6.0 Students understand soils and plant production:

- G6.1 Understand soil types, soil texture, structure, and bulk density and explain the U.S. Department of Agriculture (USDA) soil-quality rating procedure.
- G6.2 Understand soil properties necessary for successful plant production, including pH, EC, and essential nutrients.
- G6.3 Understand soil biology and diagram the soil food chain.
- G6.4 Understand how soil biology affects the environment and natural resources.

G7.0 Students understand effective tillage and soil conservation management practices:

- G7.1 Understand how to effectively manage and conserve soil through conventional, minimum, conservation, and no-tillage irrigation and through drainage and tillage practices.
- G7.2 Understand how global positioning systems, surveying, laser leveling, and other tillage practices conserve soil.
- G7.3 Use tools such as the USDA and the local Resource Conservation District soil survey maps to determine appropriate soil management practices.

G8.0 Students understand effective water management practices:

- G8.1 Understand California water history, current issues, water rights, water law, and water transfer through different distribution projects throughout the state.
- G8.2 Understand the local, state, and federal agencies that regulate water quality and availability in California.

- G8.3 Understand the definition of a watershed and how it is used to measure water quality.
- G8.4 Understand effective water management and conservation practices, including the use of tailwater ponds.
- G8.5 Know water-testing standards and perform bioassay and macro-invertebrate protocols to assess water quality.

G9.0 Students understand the concept of an “agrosystem” approach to production:

- G9.1 Understand how to identify and classify the plants and animals in an agricultural system (as producers, consumers, or decomposers).
- G9.2 Understand the elements of conventional, sustainable, and organic production systems.
- G9.3 Understand the components of “whole-system management.”

G10.0 Students understand local crop management and production practices:

- G10.1 Understand local cultural techniques, including monitoring, pruning, fertilization, planting, irrigation, harvest treatments, processing, and packaging practices for various tree, grain, hay, and vegetable classes.
- G10.2 Understand common marketing and shipping characteristics of local commodities.
- G10.3 Understand general maturity and harvest-time guidelines for specific local plant products.

G11.0 Students understand plant biotechnology:

- G11.1 Understand how changing technology—such as micropropagation, biological pest controls, and genetic engineering (including DNA extraction and gel electrophoresis)—affects plant production, yields, and management.
- G11.2 Understand the various technology advancements that affect plant and soil science (such as global positioning systems, global information systems, variable rate technology, and remote sensing).
- G11.3 Know how herbicide-resistant plant genes can affect the environment.
- G11.4 Understand how genetic engineering techniques have been used to improve crop yields.
- G11.5 Understand the effects of agricultural biotechnology, including genetically modified organisms, on the agriculture industry and the larger society and the pros and cons of such use.

Glossary



career pathway	A coherent sequence of rigorous academic and technical courses that allows students to apply academics and develop technical skills in a curricular area. Career pathways prepare students for successful completion of state academic and technical standards and more advanced postsecondary course work related to the career in which they are interested.
declarative knowledge	Information (facts, events, concepts, and principles).
foundation standards	The standards all students need to achieve to master workplace competencies both in the career technical education curriculum and in the workplace. The Secretary’s Commission on Achieving Necessary Skills refers to these essentials as “foundation skills.”
industry sector	A grouping of interrelated occupations and broad industries based on commonalities.
pathway standards	Concise statements that reflect the essential knowledge and skills students are expected to master. Each career pathway comprises three to twelve standards, with two to six subcomponents per standard.
procedural knowledge	Skills (applied abilities or knowledge).
secondary level	A term that describes students’ second level of education; elementary education is the first level. Although the secondary level of education is commonly associated with high school, it may cover grades seven through twelve.
standards	General expectations of what students should know and be able to do.
subcomponents	The specific knowledge and skills encompassed by the standard. These statements are listed below the standard and describe the knowledge and skills expected of students as they move toward mastery of the career technical education standard.



Selected References

This section begins with a list of standard references that have wide application across many areas of kindergarten-through-grade-twelve education and continues with references arranged according to the industry sector to which they apply. The references were provided by the High School Initiatives/Career Education Office. Questions about the information should be addressed to that office at (916) 319-0893.

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