California CTE

Agriculture and Natural Resources

Adopted 2013

Knowledge and Performance

1 Academics 1

2 Communications 2

1 Recognize the elements of communication using a sender–receiver model. 2.1

2 Identify barriers to accurate and appropriate communication. 2.2

3 Interpret verbal and nonverbal communications and respond appropriately. 2.3

4 Demonstrate elements of written and electronic communication, such as accurate spelling, grammar, and format. 2.4

5 Communicate information and ideas effectively to multiple audiences using a variety of media and formats. 2.5

6 Advocate and practice safe, legal, and responsible use of digital media information and communications technologies. 2.6

3 Career Planning and Management 3

1 Identify personal interests, aptitudes, information, and skills necessary for informed career decision making. 3.1

2 Evaluate personal character traits, such as trust, respect, and responsibility, and understand the impact they can have on career success. 3.2

3 Explore how information and communication technologies are used in career planning and decision making. 3.3

4 Research the scope of career opportunities available and the requirements for education, training, certification, and licensure. 3.4

5 Integrate changing employment trends, societal needs, and economic conditions into career planning. 3.5

6 Recognize the role and function of professional organizations, industry associations, and organized labor in a productive society. 3.6

7 Recognize the importance of small business in the California and global economies. 3.7

8 Understand how digital media are used by potential employers and postsecondary agencies to evaluate candidates. 3.8

Skip to main content

9 Develop a career plan that reflects career interests, pathways, and postsecondary options. 3.9

4 Technology 4

1 Use electronic reference materials to gather information and produce products and services. 4.1

2 Employ Web-based communications responsibly and effectively to explore complex systems and issues. 4.2

3 Use information and communication technologies to synthesize, summarize, compare, and contrast information from multiple sources. 4.3

4 Discern the quality and value of information collected using digital technologies, and recognize bias and intent of the associated sources. 4.4

5 Research past, present, and projected technological advances as they impact a particular pathway. 4.5

6 Assess the value of various information and communication technologies to interact with constituent populations as part of a search of the current literature or in relation to the information task. 4.6

7 Demonstrate the use of appropriate tools and technology used in the Agriculture and Natural Resources sector. 4.7

5 Problem Solving and Critical Thinking 5

1 Identify and ask significant questions that clarify various points of view to solve problems. 5.1

2 Solve predictable and unpredictable work-related problems using various types of reasoning (inductive, deductive) as appropriate. 5.2

3 Use systems thinking to analyze how various components interact with each other to produce outcomes in a complex work environment. 5.3

4 Interpret information and draw conclusions, based on the best analysis, to make informed decisions. 5.4

6 Health and Safety 6

1 Locate, and adhere to, Material Safety Data Sheet (MSDS) instructions. 6.1

2 Interpret policies, procedures, and regulations for the workplace environment, including employer and employee responsibilities. 6.2

3 Use health and safety practices for storing, cleaning, and maintaining tools, equipment, and supplies. 6.3

4 Practice personal safety when lifting, bending, or moving equipment and supplies. 6.4

5 Demonstrate how to prevent and respond to work-related accidents or injuries; this includes demonstrating an understanding of ergonomics. 6.5

Skip to main content

6 Maintain a safe and healthful working environment. 6.6

7 Be informed of laws/acts pertaining to the Occupational Safety and Health Administration (OSHA). 6.7

7 Responsibility and Flexibility 7

1 Recognize how financial management impacts the economy, workforce, and community. 7.1

2 Explain the importance of accountability and responsibility in fulfilling personal, community, and workplace roles. 7.2

3 Understand the need to adapt to changing and varied roles and responsibilities. 7.3

4 Practice time management and efficiency to fulfill responsibilities. 7.4

5 Apply high-quality techniques to product or presentation design and development. 7.5

6 Demonstrate knowledge and practice of responsible financial management. 7.6

7 Demonstrate the qualities and behaviors that constitute a positive and professional work demeanor, including appropriate attire for the profession. 7.7

8 Explore issues of global significance and document the impact on the Agriculture and Natural Resources sector. 7.8

8 Ethics and Legal Responsibilities 8

1 Access, analyze, and implement quality assurance standards of practice. 8.1

2 Identify local, district, state, and federal regulatory agencies, entities, laws, and regulations related to the Agriculture and Natural Resources industry sector. 8.2

3 Demonstrate ethical and legal practices consistent with Agriculture and Natural Resources sector workplace standards. 8.3

4 Explain the importance of personal integrity, confidentiality, and ethical behavior in the workplace. 8.4

5 Analyze organizational culture and practices within the workplace environment. 8.5

6 Adhere to copyright and intellectual property laws and regulations, and use and appropriately cite proprietary information. 8.6

7 Conform to rules and regulations regarding sharing of confidential information, as determined by Agriculture and Natural Resources sector laws and practices. 8.7

9 Leadership and Teamwork 9

1 Define leadership and identify the responsibilities, competencies, and behaviors of successful leaders. 9.1

2 Identify the characteristics of successful teams, including leadership, cooperation, collaboration, and effective decision-making skills, as applied in groups, teams, and career technical student organization activities. 9.2

Skip to main content

Understand the characteristics and benefits of teamwork, leadership, and citizenship in the school, community, and workplace setting. 9.3

4 Explain how professional associations and organizations and associated leadership development and competitive career development activities enhance academic preparation, promote career choices, and contribute to employment opportunities. 9.4

5 Understand that the modern world is an international community and requires an expanded global view. 9.5

6 Respect individual and cultural differences and recognize the importance of diversity in the workplace. 9.6

7 Participate in interactive teamwork to solve real Agriculture and Natural Resources sector issues and problems. 9.7

8 Define the characteristics and benefits of teamwork, leadership, and citizenship in the school, community, and workplace settings. 9.8

9 Identify the ways in which pre-professional associations, such as the Future Farmers of America (FFA), and competitive career development activities enhance academic skills, promote career choices, and contribute to employability. 9.9

1 Understand how to organize and structure work, individually and in teams, for effective performance and the attainment of goals. 9.1

11 Explain multiple approaches to conflict resolution and their appropriateness for a variety of situations in the workplace. 9.11

12 Demonstrate how to interact with others in ways that demonstrate respect for individual and cultural differences and for the attitudes and feelings of others. 9.12

13 Participate in group or team activities, including those offered by the student organization, that develop skills in leadership, cooperation, collaboration, and effective decision making. 9.13

10 Technical Knowledge and Skills 10

1 Interpret and explain terminology and practices specific to the Agriculture and Natural Resources sector. 10.1

2 Comply with the rules, regulations, and expectations of all aspects of the Agriculture and Natural Resources sector. 10.2

3 Construct projects and products specific to the Agriculture and Natural Resources sector requirements and expectations. 10.3

4 Collaborate with industry experts for specific technical knowledge and skills. 10.4

5 Interpret and explain the aims, purposes, history, and structure of the FFA student organization and know the opportunities it makes available. 10.5

6 Manage, and actively engage in, a career-related, supervised agricultural experience. 10.6

7 Understand the importance of maintaining and completing the California Agricultural Record Book. 10.7

8 Maintain and troubleshoot equipment used in the agricultural industry. 10.8

Skip to main content

-- Demonstration and Application 11

1. Utilize work-based/workplace learning experiences to demonstrate and expand upon knowledge and skills gained during classroom instruction and laboratory practices specific to the Agriculture and Natural Resources sector program of study. 11.1
2. Demonstrate proficiency in a career technical pathway that leads to certification, licensure, and/or continued learning at the postsecondary level. 11.2
3. Demonstrate entrepreneurship skills and knowledge of self-employment options and innovative ventures. 11.3
4. Employ entrepreneurial practices and behaviors appropriate to Agriculture and Natural Resources sector opportunities. 11.4
5. Create a portfolio, or similar collection of work, that offers evidence through assessment and evaluation of skills and knowledge competency as contained in the anchor standards, pathway standards, and performance indicators. 11.5

Pathway Standards

. **Agricultural Business Pathway** A.

1. Demonstrate an understanding of decision-making processes within the American freeenterprise system. A1.0
    1. Differentiate among the components of the American free-enterprise system and other forms of economic systems. A1.1
    2. Distinguish among the main characteristics of individual proprietorships, partnerships, corporations, franchises, and cooperatives. A1.2
    3. Compare the advantages and disadvantages of the types of business ownership. A1.3
    4. Analyze appropriate decision-making tools and financial records to make key management decisions. A1.4
    5. Analyze physical production relationships to determine optimum use levels. A1.5
    6. Calculate the fixed and variable costs associated with the production of agricultural products and determine the output level that will yield maximum profit. A1.6
2. Explain the fundamental economic principles of agribusiness and agricultural production. A2.0
    1. Identify basic economic factors affecting agricultural production and agribusiness management decisions. A2.1
    2. Communicate basic agricultural economic terminology. A2.2
    3. Apply the law of supply and demand and evaluate its effect on price determination. A2.3
    4. Assess how agriculture uses scarce resources to meet the needs and demands of its consumers. A2.4
    5. Differentiate between elastic and inelastic supply and demand. A2.5
    6. Predict how the law of diminishing returns impacts agricultural production. A2.6

Skip to main content

3. Explore the role of credit in agribusiness and agricultural production. A3.0
    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-term, intermediate-term, and long-term credit). A3.1
    2. Research and discuss the criteria lenders use to evaluate repayment capacity. A3.2
    3. Evaluate balance sheets and cash-flow statements to determine the ability to repay loans. A3.3
4. Use proper accounting principles and procedures to accomplish fiscal management and tax planning. A4.0
    1. Compare and contrast cash and accrual accounting systems. A4.1
    2. Demonstrate the use and describe the importance of budgets, income statements, balance sheets, and financial statements. A4.2
    3. Interpret the basis of taxation within the tax system and its impact on the economy, including the role of taxes in agribusiness. A4.3
    4. Analyze the role of depreciation and purchasing in tax planning and liability. A4.4
    5. Determine property values and complete a depreciation schedule. A4.5
    6. Formulate the tax obligations for an agribusiness. A4.6
5. Manage risk and uncertainty. A5.0
    1. Explore environmental issues that impact agribusiness. A5.1
    2. Determine the meaning and importance of risk and uncertainty. A5.2
    3. Describe alternative approaches to reducing risk, including the use of insurance for product liability, property, production or income loss, and for personnel life and health. A5.3
    4. Maintain appropriate evidence (e.g., Point of Origin, pick/pack dates, production records) to support and defend risk management. A5.4
    5. Identify best practices and include in farm planning to reduce risk. A5.5
    6. Prepare a comprehensive risk management and contingency plan. A5.6
6. Evaluate the role and value of agricultural organizations. A6.0
    1. Distinguish the benefits of private, public, and governmental organizations, including the value and impact of cooperatives. A6.1
    2. Understand how participation in organizations would be beneficial in supporting various agricultural operations. A6.2
    3. Identify, and electronically access, public and private agricultural organizations. A6.3

Skip to main content

7 Understand agricultural marketing systems. A7.0

1 Explain how marketing functions in a free-market society. A7.1

2 Compare the advantages and disadvantages of the various marketing options for agricultural products and services. A7.2

3 Analyze how the law of comparative advantage affects agricultural production. A7.3

4 Explore the impact of advertising, promotion, and data analysis on the marketing of agricultural products and services. A7.4

5 Assess how promotion trends for agricultural products influence individuals. A7.5

6 Develop a marketing plan for an agricultural product or service. A7.6

8 Understand the sales of agricultural products and services. A8.0

1 Determine the most effective methods for assessing customer needs and wants. A8.1

2 Describe the stages in making a successful sale and the various techniques used to approach potential customers and overcome their objections. A8.2

3 Examine the physiological and psychological factors that influence motivation to purchase, including the fundamental steps in making a purchase. A8.3

9 Differentiate among local, national, and international agricultural markets and communicate how trade affects the economy. A9.0

1 Describe how the importance of agricultural imports and exports affects state and national economies. A9.1

2 Summarize how governmental, economic, and cultural factors affect international trade. A9.2

3 Compare and contrast United States trade policies with those of other important trading partners. A9.3

4 Research how biotechnology affects trade and global economies. A9.4

5 Evaluate how different cultural values affect agricultural production and marketing. A9.5

6 Explain how negotiations and bargaining agreements affect trade agreements. A9.6

7 Analyze agricultural marketing strategies in other parts of the world. A9.7

. **Agricultural Mechanics Pathway** B.

1 Implement personal and group safety practices. B1.0

1 Practice the rules for personal and group safety while working in an agricultural mechanics environment. B1.1

2 Integrate accepted shop management procedures and a safe working environment. B1.2

3 Safely secure loads on a variety of vehicles. B1.3

Skip to main content

2. Apply the principles of basic woodworking. B2.0
    1. Identify common wood products, lumber types, and sizes. B2.1
    2. Measure and lay out lumber, calculating board feet and square feet. B2.2
    3. Identify, select, and implement basic fastening systems. B2.3
    4. Complete a woodworking project, including interpreting a plan, developing a bill of materials and cutting list, selecting materials, shaping, joining, and finishing. B2.4
3. Demonstrate basic electricity principles and wiring practices commonly used in agriculture. B3.0
    1. Explain the relationship between voltage, amperage, resistance, and power in single-phase alternating current (AC) circuits. B3.1
    2. Use proper electrical test equipment for AC and direct current (DC) circuits. B3.2
    3. Analyze and correct basic circuit problems (e.g., open circuits, short circuits, incorrect grounding). B3.3
    4. Implement proper basic electrical circuit and wiring techniques using nonmetallic cable and conduit as defined by the National Electric Code (NEC). B3.4
    5. Interpret basic agricultural electrical plans. B3.5
    6. Complete an electrical project, including interpreting a plan, following NEC code, selecting materials and components, and completing a circuit. B3.6
4. Select and apply plumbing system practices commonly used in agriculture. B4.0
    1. Match appropriate basic plumbing fitting skills with a variety of materials, such as copper, polyvinyl chloride (PVC), steel, polyethylene, and acrylonitrile butadiene styrene (ABS). B4.1
    2. Explain the environmental influences on plumbing and irrigation system choices (e.g., filter systems, water disposal, drip vs. flood). B4.2
    3. Research and communicate how various plumbing and irrigation systems are used in agriculture. B4.3
    4. Complete a plumbing project, including interpreting a plan, developing a bill of materials and cutting list, selecting materials, joining, and testing. B4.4
5. Understand agricultural cold metal processes. B5.0
    1. Identify common metals, sizes, and shapes. B5.1
    2. Demonstrate basic tool-fitting skills. B5.2
    3. Properly lay out materials for a given project. B5.3
    4. Demonstrate basic cold metal processes (e.g., shearing, cutting, drilling, threading, bending). B5.4
    5. Complete a cold metal project, including interpreting a plan, developing a bill of materials, selecting materials, shaping, fastening, and finishing. B5.5

Skip to main content

6 Understand concrete and masonry practices commonly used in agriculture. B6.0

1 Identify and explain the use of concrete and masonry tools and demonstrate proper handling of concrete materials. B6.1

2 Practice bed preparation, concrete forms layout, and construction. B6.2

3 Complete a concrete or masonry project, including calculating volume, developing a bill of materials, assembling, mixing, placing, and finishing. B6.3

7 Understand oxy-fuel cutting and welding. B7.0

1 Explain the role of heat and oxidation in the cutting process. B7.1

2 Properly set up, adjust, shut down, and maintain an oxy-fuel system. B7.2

3 Flame-cut metal with an oxy-fuel cutting torch. B7.3

4 Fusion-weld mild steel with and without filler rod by using oxy-fuel equipment. B7.4

5 Repair metal objects using a variety of techniques, such as brazing or hard surfacing. B7.5

8 Understand electric arc welding processes. B8.0

1 Select, properly adjust, safely employ, and maintain appropriate welding equipment (e.g., gas metal arc welding, shielded metal arc welding, gas tungsten arc welding). B8.1

2 Read welding symbols and plans, select electrodes, fit-up joints, and control heat and distortion. B8.2

3 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

4 Weld a variety of joints in various positions. B8.4

9 Assimilate metallurgy principles and fabrication techniques. B9.0

1 Define metallurgy principles, including distortion, hardening, tempering, and annealing. B9.1

3 Operate and maintain various arc welding and cutting systems safely and appropriately. B9.3

3 Operate and maintain fabrication tools and equipment safely and appropriately. B9.3

4 Design project plans by using mechanical drawing techniques. B9.4

5 Finish a metal project by implementing proper sequencing. B9.5

6 Manipulate and finish metal by using a variety of tools, machines, and techniques (e.g., lathe, mill, CNC plasma, shears, press break, grinders, and sanders). B9.6

7 Construct a welding project using any electric welding process, appropriate products, joints, and positions, which will include interpreting a plan, determining proper assembly sequence, developing a bill of materials and cutting list, selecting and acquiring materials, and developing a clear and concise fabrication contract. B9.7

Skip to main content

10 Understand small and compact engines. B10.0

1 Understand and explain engine theory, including the application of mathematical and/or physical science laws for both two- and four-stroke cycle engines. B10.1

2 Differentiate among types of small engines and their applications. B10.2

3 Identify small-engine parts and explain the various systems (e.g., fuel, ignition, compression, cooling, and lubrication systems). B10.3

4 Troubleshoot and solve problems with small engines. B10.4

5 Disassemble, inspect, adjust, and reassemble a small engine. B10.5

6 Look up and order parts, apply repair and maintenance recommendations from a repair manual, and complete appropriate forms, including work orders. B10.6

11 Understand the principles and applications of various engines and machinery used in agriculture. B11.0

1 Identify common agricultural machinery and implements. B11.1

2 Calibrate, operate, and maintain equipment safely and efficiently. B11.2

3 Summarize the theory, operation, and troubleshooting of various types of engines found on agricultural machinery, including cooling, fuel, and lubrication systems. B11.3

4 Explain the theory, operation, and troubleshooting of hydraulic systems. B11.4

5 Explain the theory, operation, and troubleshooting of power train and power take-off systems. B11.5

6 Understand the theory and operation of 12-volt DC electronic and electrical systems (e.g., circuit design, starting, charging, and safety circuits). B11.6

12 Apply land measurement and construction techniques commonly used in agriculture. B12.0

1 Describe common surveying techniques used in agriculture (e.g., leveling, land measurement, building layout, GPS). B12.1

2 Draw and interpret architectural plans. B12.2

3 Install single- and three-phase wiring and control systems found in agricultural structures, pumps, and irrigation systems. B12.3

4 Install plumbing in agricultural structures (e.g., potable water, sewer, irrigation). B12.4

5 Form, place, and finish concrete or masonry (e.g., concrete block). B12.5

6 Construct agricultural structures by using wood framing and steel framing systems (e.g., barns, shops, greenhouses, animal structures). B12.6

7 Develop clear and concise agricultural construction contracts. B12.7

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Skip to main content

1. Evaluate the role of agriculture in the California economy. C1.0
    1. Understand the history of the agricultural industry in California. C1.1
    2. Describe how California agriculture affects the quality of life. C1.2
    3. Analyze the interrelationship of California agriculture and society at the local, state, national, and international levels. C1.3
    4. Research the economic impact of leading California agricultural commodities. C1.4
    5. Assess the economic impact of major natural resources in California. C1.5
    6. Distinguish between the economic importance of major agricultural exports and imports. C1.6
    7. Explore factors that affect food safety and producers' responsibilities to consumers. C1.7
2. Examine the interrelationship between agriculture and the environment. C2.0
    1. Identify important agricultural environmental impacts on soil, water, and air. C2.1
    2. Explain current environmental challenges related to agriculture. C2.2
    3. Summarize how natural resources are used in agriculture. C2.3
    4. Compare and contrast practices for conserving renewable and nonrenewable resources. C2.4
    5. Research how new energy sources are developed from agricultural products (e.g., gascogeneration and ethanol). C2.5
3. Analyze the effects of technology on agriculture. C3.0
    1. Describe how technology affects the logistics of moving an agricultural commodity from producer to consumer. C3.1
    2. Understand how technology influences factors such as labor, efficiency, diversity, availability, mechanization, and communication. C3.2
    3. Communicate public concern for technological advancements in agriculture, such as genetically modified organisms. C3.3
    4. Research the laws and regulations concerning biotechnology. C3.4
    5. Integrate the use of technology when collecting and analyzing data. C3.5
4. Determine the importance of animals, the domestication of animals, and the role of animals in modern society. C4.0
    1. Understand the evolution and roles of domesticated animals in society. C4.1
    2. Differentiate between domestication and natural selection. C4.2
    3. Compile the modern-day uses of animals and animal by-products. C4.3
    4. Defend various points of view regarding the use of animals. C4.4
    5. Research unique and alternative uses of animals (e.g., therapeutic riding programs and companion animals). C4.5

Skip to main content

5 Compare the structure and function of plants, animals, bacteria, and viruses. C5.0

1 Identify the function of cells. C5.1

2 Analyze the anatomy and physiology of cells. C5.2

3 Understand various cell actions, such as osmosis and cell division. C5.3

4 Compare and contrast plant and animal cells, bacteria, and viruses. C5.4

6 Explore animal anatomy and systems. C6.0

1 State the names, and find the locations, of the external anatomy of animals. C6.1

2 Explain the anatomy and major functions of vertebrate systems, including digestive, reproductive, circulatory, nervous, muscular, skeletal, respiratory, and endocrine systems. C6.2

7 Comprehend basic animal genetics. C7.0

1 Differentiate between genotype and phenotype and describe how dominant and recessive genes function. C7.1

2 Compare genetic characteristics among cattle, sheep, swine, and horse breeds. C7.2

3 Predict phenotype and genotype ratios by using a Punnett Square. C7.3

4 Explain the fertilization process. C7.4

5 Distinguish between the purpose and processes of mitosis and meiosis. C7.5

8 Understand fundamental animal nutrition and feeding. C8.0

1 Identify types of nutrients required by farm animals (e.g., proteins, minerals, vitamins, carbohydrates, fats/oils, water). C8.1

2 Analyze suitable common feed ingredients, including forages, roughages, concentrates, and supplements for ruminant, monogastric, equine, and avian digestive systems. C8.2

3 Understand basic animal feeding guidelines and evaluate sample feeding programs for various species, including space requirements and economic considerations. C8.3

9 Evaluate basic animal health. C9.0

1 Assess the appearance and behavior of a normal, healthy animal. C9.1

2 Explain the ways in which housing, sanitation, and nutrition influence animal health and behavior. C9.2

3 Analyze the causes and controls of common animal diseases. C9.3

4 Summarize effective techniques for controlling parasites and explain why controlling parasites is important. C9.4

5 Research the legal requirements for the procurement, storage, methods of application, and withdrawal times of animal medications, and know proper equipment handling and disposal techniques. C9.5

Skip to main content

10 Explain soil science principles. C10.0

1 Recognize the major soil components and types. C10.1

2 Summarize how soil texture, structure, pH, and salinity affect plant growth. C10.2

3 Assess water delivery and irrigation system options. C10.3

4 Differentiate among the types, uses, and applications of amendments and fertilizers. C10.4

11 Analyze plant growth and development. C11.0

1 Understand the anatomy and functions of plant systems and structures. C11.1

2 Identify plant growth requirements. C11.2

3 Discern between annual, biennial, and perennial life cycles. C11.3

4 Examine sexual and asexual reproduction in plants. C11.4

5 Understand photosynthesis and the roles of the sun, chlorophyll, sugar, oxygen, carbon dioxide, and water in the process. C11.5

6 Summarize the respiration process in the breakdown of food and organic matter. C11.6

12 Understand fundamental pest management. C12.0

1 Classify agricultural pests (e.g., insects, weeds, disease, and vertebrates). C12.1

2 Compare chemical, mechanical, cultural, and biological methods of plant pest control. C12.2

3 Analyze the major principles, advantages, and disadvantages of integrated pest management. C12.3

13 Design agricultural experiments using the scientific method. C13.0

1 State the steps of the scientific method. C13.1

2 Analyze an agricultural problem and devise a solution based on the scientific method. C13.2

. **Animal Science Pathway** D.

Skip to main content

1. Evaluate the necessary elements for proper animal housing and animal-handling equipment. D1.0
    1. Design an animal facility focusing on appropriate space and location requirements for habitat, housing, feed, and water. D1.1
    2. 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. D1.2
    3. Interpret animal behaviors and execute protocols for safe handling of animals. D1.3
    4. Defend the purpose and the safe and humane use of animal husbandry tools, such as hoof trimmers, electric shears, elastrators, dehorning tools, and scales. D1.4
2. Apply principles of animal nutrition to ensure the proper growth, development, reproduction, and economic production of animals. D2.0
    1. Assess the flow of nutrients from the soil, through the animal, and back to the soil. D2.1
    2. Explore the principles for providing proper, balanced rations for a variety of production stages in ruminants and monogastrics. D2.2
    3. Compare the digestive processes of the ruminant, monogastric, avian, and equine digestive systems. D2.3
    4. Distinguish how animal nutrition is affected by the digestive, endocrine, and circulatory systems. D2.4
3. Apply principles of comparative anatomy and physiology to uses within various animal systems. D3.0
    1. Compare and contrast animal cells, tissues, organs, and body systems. D3.1
    2. Develop efficient procedures to produce consistently high-quality animals that are well suited for their intended purposes. D3.2
    3. Relate the importance of animal organs to the health, growth, and reproduction of animals. D3.3
4. Demonstrate understanding of animal reproduction, including the function of reproductive organs. D4.0
    1. Illustrate animal conception, including estrus cycles, ovulation, and insemination. D4.1
    2. Research the gestation process and basic fetal development. D4.2
    3. Explain the parturition process, including the identification of potential problems and their solutions. D4.3
    4. Select animal breeding methods based on reproductive and economic efficiency. D4.4
    5. Select a breeding system based on the principles of genetics. D4.5

Skip to main content

5 Discuss animal inheritance and selection principles, including the structure and role of deoxyribonucleic acid (DNA). D5.0

1 Evaluate a group of animals for desired qualities, and discern among them for breeding selection. D5.1

2 Select animals, based on quantitative breeding values, for specific characteristics. D5.2

3 Research and discuss current technology used to measure desirable traits. D5.3

4 Predict phenotypic and genotypic results of a dominant and recessive gene pair. D5.4

5 Research the role of mutations, both naturally occurring and artificially induced, and hybrids in animal genetics. D5.5

6 Prescribe and implement a prevention treatment program for animal diseases, parasites, and other disorders. D6.0

1 Evaluate the signs of normal health in contrast to illness and disease. D6.1

2 Analyze the importance of animal behavior in diagnosing animal sickness and disease. D6.2

3 Research common pathogens, vectors, and hosts that cause disease in animals. D6.3

4 Evaluate preventative measures for controlling and limiting the spread of diseases, parasites, and disorders among animals. D6.4

5 Discuss procedures used at the local, state, and national levels to ensure biosecurity of the animal industry. D6.5

6 Explain the health risk of zoonotic diseases to humans, their historical influence, and future implications. D6.6

7 Discuss the impacts on local, national, and global economies, as well as on consumers and producers, when animal diseases are not appropriately contained and eradicated. D6.7

7 Explore common pasture and rangeland management practices and their impact on a balanced ecosystem. D7.0

1 Evaluate a rangeland and identify methods of rangeland improvement used in an effective animal production program. D7.1

2 Summarize how rangeland management practices affect pasture production, erosion control, and the general balance of the ecosystem. D7.2

3 Develop a management plan for rangelands, including how to calculate carrying capacity, for a variety of animal species and locations. D7.3

4 Evaluate a plan to balance rangeland use for animal grazing and for wildlife habitat. D7.4

Skip to main content

8. Explain challenges associated with animal waste management. D8.0
    1. Assess treatment and disposal management systems for animal waste. D8.1
    2. Compare various methods for using animal waste and the environmental impacts associated with each method. D8.2
    3. Research the health and safety regulations that are an integral part of properly managed animal waste systems. D8.3
9. Assess animal welfare concerns and management practices that support animal welfare. D9.0
    1. Evaluate the early warning signs of animal distress and how to rectify the problem. D9.1
    2. Discuss consumer concerns with animal production practices relative to human health. D9.2
    3. Summarize federal and state animal welfare laws and regulations, such as those dealing with abandoned and neglected animals, animal fighting, euthanasia, and medical research. D9.3
    4. Research the regulations for humane transportation and harvesting of animals, such as those delineated by the U.S. Department of Agriculture (USDA) Food Safety and Inspection Service and the Humane Methods of Slaughter Act. D9.4
10. Demonstrate understanding of the production of large animals (e.g., cattle, horses, swine, sheep, goats) and small animals (e.g., poultry, cavy, rabbits). D10.0
    1. Formulate and implement optimum requirements for diet, genetics, habitat, and behavior in the production of large and small animals. D10.1
    2. Develop, maintain, and use growth and management records for large or small animals to make data-driven management decisions. D10.2
11. Demonstrate understanding of the production of specialty animals (e.g., fish, marine animals, llamas, and tall, flightless birds). D11.0
    1. Assess specialty animals' role in agriculture (e.g., fish farms, pack animals, working dogs). D11.1
    2. Explore the unique nutrition, health, and habitat requirements for specialty animals. D11.2
    3. Synthesize and implement optimum requirements for diet, genetics, habitat, and behavior in the production of specialty animals. D11.3
    4. Develop, maintain, and utilize growth and management records for specialty animals to make data-driven management decisions. D11.4

Skip to main content

12 Understand how animal products and by-products are processed and marketed. D12.0

1 Research 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, Sanitation Standard Operating Procedures, and good manufacturing practices documents. D12.1

2 Compare the relative importance of the major meat, dairy, and egg classifications, including the per-capita consumption and nutritive value of those classifications. D12.2

3 Discuss how meat-based, dairy, and egg retail products are produced. D12.3

4 Describe how nonmeat products, such as wool, pelts, hides, and by-products, are harvested and processed. D12.4

5 Evaluate how meat products and nonmeat products are marketed. D12.5

6 Compare the value of animal by-products to nonagricultural industries. D12.6

7 Apply point-of-origin safety and sanitation procedures in the production, harvest, handling, processing, and storing of meat products. D12.7

. **Forestry and Natural Resources Pathway** E.

1 Understand the importance of energy and energy cycles. E1.0

1 Diagram the oxygen, carbon, nitrogen, and water cycles. E1.1

2 Differentiate between renewable and nonrenewable energy sources. E1.2

3 Differentiate between natural resource management conservation strategies and preservation strategies. E1.3

4 Compare the effects on air and water quality of using different forms of energy. E1.4

5 Analyze the way in which human activities influence energy cycles and natural resource management. E1.5

2 Understand air and water use, their management practices, and conservation strategies. E2.0

1 Explain the government's role in regulating air, soil, and water use management practices and conservation strategies. E2.1

2 Research and discuss air and water conservation issues. E2.2

3 Define appropriate water conservation measures. E2.3

4 Interpret the component of a plan that monitors water quality. E2.4

5 Interpret the component of a plan that monitors air quality. E2.5

6 Analyze the way in which water management affects the environment and human needs. E2.6

Skip to main content

3. Explore soil composition and soil management. E3.0
    1. Demonstrate techniques used to classify soils. E3.1
    2. Explain the reasons for, and importance of, soil conservation. E3.2
    3. Analyze soils found in the different natural resource management areas. E3.3
    4. Develop and implement a soil management plan for a natural resource management area. E3.4
    5. Understand how to analyze existing soil surveys to develop effective management plans. E3.5
4. Explore rangeland management. E4.0
    1. Map the locations of major U.S. and California rangeland areas. E4.1
    2. Summarize the interrelationship of rangeland management, the environment, wildlife management, and the livestock industry. E4.2
    3. Define practices used to improve rangeland quality. E4.3
    4. Analyze the carrying capacity in various rangelands for both wildlife species and domestic livestock. E4.4
    5. Distinguish among different browse and forage species in California rangelands. E4.5
    6. Evaluate a rangeland and develop a rangeland monitoring plan. E4.6
    7. Analyze 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) and abide by specific laws pertaining to natural resource systems. E4.7
5. Investigate wildlife management and habitat. E5.0
    1. Describe the relationship between habitat and wildlife population. E5.1
    2. List habitat requirements for different species and identify factors that influence population dynamics. E5.2
    3. Determine existing wildlife species populations. E5.3
    4. Explain mammalian and avian reproductive processes and infer how nutrition and habitat affect reproduction and population. E5.4
    5. Differentiate among a variety of management practices used to manage wildlife populations for hunting and other recreational purposes. E5.5
    6. Analyze the economic and environmental significance of sport hunting and fishing industries. E5.6
    7. Research and report on the purpose, history, terminology, and challenges of the Endangered Species Act and current activities related to the Act. E5.7

Skip to main content

6 Understand aquatic resource use and management. E6.0

1 Summarize the different types of aquatic resources. E6.1

2 Identify and describe the major body parts, digestive systems, and reproductive organs of aquatic species. E6.2

3 Determine the populations of existing aquatic species using a variety of methods. E6.3

4 Analyze the relationship between water quality and aquatic species habitat. E6.4

5 Explore a variety of management practices for managing aquatic species for sport fishing and other purposes. E6.5

6 Make financial and production decisions and maintain growth and management records for a selected aquatic species. E6.6

7 Understand the outdoor recreation industry. E7.0

1 List the potential environmental impacts of recreational activities and describe how to manage the resources affected. E7.1

2 Demonstrate basic survival skills and first aid procedures. E7.2

3 Construct and maintain trails. E7.3

4 Select appropriate recreational gear for trips of varying types and durations and how to use it safely and appropriately (for minimum environmental impact). E7.4

5 Set up a campsite for minimum environmental impact. E7.5

8 Explore basic plant physiology, anatomy, and taxonomy. E8.0

1 Use scientific method to classify animals, including order, family, genus, and species. E8.1

2 Use a dichotomous key to identify plants and animals. E8.2

3 Identify local trees, shrubs, grasses, forbs, and wildlife species by common name. E8.3

4 Recognize and explain the factors that influence plant growth, such as respiration, temperature, nutrients, and photosynthesis. E8.4

9 Explore the role of fire in natural resource management. E9.0

1 Differentiate between desirable and undesirable fire in forest and rangeland ecosystems. E9.1

2 Explain the significance of each of the components of the "fire triangle." E9.2

3 Know appropriate wildland fire-suppression practices. E9.3

4 Develop a fire-control plan. E9.4

5 Use fire-control tools safely. E9.5

6 Research and report on the training requirements for fire-suppression certification. E9.6

Skip to main content

10 Implement forest management practices. E10.0

1 Describe how social, political, and economic factors can affect the use of forests. E10.1

2 Discuss the California Forest Practice Act and the requirements for Timber Harvest and Habitat Conservation Plans. E10.2

3 Analyze forest management systems (e.g., sustained yield, watershed management, ecosystem management, multiple-use management). E10.3

4 Analyze harvest and renewability (e.g., reseeding and thinning) systems and identify the impact of each on the land. E10.4

5 Explain silvicultural systems and skills and use appropriate related tools. E10.5

6 Identify and diagnose damage from destructive insects, diseases, and weather and choose methods for their management. E10.6

11 Understand the basic concepts of measurement, surveying, and mapping. E11.0

1 Describe the Public Land Survey System. E11.1

2 Use surveying equipment, including global positioning satellites, maps, and a compass, to determine area, boundaries, and elevation differences. E11.2

3 Apply timber-cruising and log-scaling skills to determine timber and log volume for management and marketing. E11.3

4 Create a management plan map that includes layer information and data points from global information systems. E11.4

12 Produce, harvest, process, and market products from natural resource industries. E12.0

1 Explain the marketing processes and manufacturing standards for a variety of natural resource products, including mining, quarrying, and drilling. E12.1

2 Process natural resource products adhering to manufacturing standards. E12.2

3 Analyze the production of specialty and seasonal products from natural resources. E12.3

4 Compare different wood types and their uses. E12.4

5 Diagram lumber manufacturing processes. E12.5

13 Understand public and private land issues. E13.0

1 Interpret the differences between publicly and privately held lands. E13.1

2 Explain the differences between public land designations (e.g., State Park, National Forest, wilderness areas, wild and scenic areas). E13.2

3 Compare the role of public and private property rights and how they affect agriculture. E13.3

4 Describe the role of government in managing public and private property rights. E13.4

Skip to main content

rnamental Horticulture Pathway F.

1. Compare and contrast the hierarchical classification of plants. F1.0
    1. Practice how to classify and identify plants by order, family, genus, and species. F1.1
    2. Demonstrate how to identify plants by using a dichotomous key. F1.2
    3. Illustrate how common plant parts are used to classify the plants. F1.3
    4. Distinguish how to classify and identify plants by using botanical growth habits, landscape uses, and cultural requirements. F1.4
    5. Identify and select plants for local landscape applications. F1.5
2. Summarize plant physiology and growth principles. F2.0
    1. Understand plant systems, nutrient transportation, structure, and energy storage. F2.1
    2. Diagram the seed's essential parts and explain the functions of each. F2.2
    3. Explain how primary, secondary, and trace elements are used in plant growth. F2.3
    4. Experiment with the factors that influence plant growth, including water, nutrients, light, soil, air, and climate. F2.4
    5. Differentiate the tissues seen in a cross section of woody and herbaceous plants. F2.5
    6. Explore the factors that affect plant growth. F2.6
3. Demonstrate plant propagation techniques. F3.0
    1. Explain the different forms of sexual and asexual plant reproduction. F3.1
    2. Demonstrate the various techniques for successful plant propagation (e.g., budding, grafting, cuttings, seeds). F3.2
    3. Utilize and monitor plant reproduction for the development of a saleable product. F3.3
4. Develop and implement a plan for basic integrated pest management. F4.0
    1. Read and interpret pesticide labels and understand safe pesticide management practices. F4.1
    2. Research how pesticide regulations and government agencies affect agriculture. F4.2
    3. Identify common horticultural pests and diseases and methods of controlling them. F4.3
    4. Design an integrated approach to solving plant problems. F4.4

Skip to main content

5. Summarize water and soil (media) management practices. F5.0
    1. Explain how basic soil science and water principles affect plant growth. F5.1
    2. Illustrate basic irrigation design and installation methods. F5.2
    3. Prepare and amend soils, implement soil conservation methods, and compare results. F5.3
    4. Research major issues related to water sources and water quality. F5.4
    5. Explain the components of soilless media and test the use of those media in various types of containers. F5.5
6. Apply ornamental plant nutrition practices. F6.0
    1. Analyze how primary and secondary nutrients and trace elements affect ornamental plants. F6.1
    2. Use basic nutrient testing procedures on soil and plant tissue. F6.2
    3. Analyze organic and inorganic fertilizers to understand their appropriate uses. F6.3
    4. Read and interpret labels to properly apply fertilizers. F6.4
7. Develop a plan for the selection, installation, and maintenance of turf. F7.0
    1. Explain the selection and management of landscape and sports field turf. F7.1
    2. Demonstrate how to select, install, and maintain a designated turf grass area. F7.2
    3. Distinguish how the use of turf benefits the environment. F7.3
8. Employ nursery production principles. F8.0
    1. Demonstrate the proper use of production facilities and common nursery equipment. F8.1
    2. Use common nursery production practices. F8.2
    3. Demonstrate how to propagate and maintain a horticultural crop to the point of sale. F8.3
    4. Design a marketing and merchandising strategy to use in nursery production. F8.4
9. Demonstrate the proper use of containers and horticultural tools, equipment, and facilities. F9.0
    1. Use different types of containers and demonstrate how to maintain growing containers in controlled environments. F9.1
    2. Operate and maintain selected hand and power equipment safely and appropriately. F9.2
    3. Select proper tools for specific horticultural jobs. F9.3
    4. Install landscape components and electrical, land, and water features. F9.4

Skip to main content

10 Understand basic landscape planning, design, construction, and maintenance. F10.0

1 Utilize terms associated with landscape and design in appropriate context. F10.1

2 Produce a residential design, including how to render design to scale using design technology and principles. F10.2

3 Use proper landscape planting and maintenance practices. F10.3

4 Prune ornamental shrubs, trees, and fruit trees. F10.4

5 Produce clear and concise landscape business contracts. F10.5

11 Understand basic floral design principles. F11.0

1 Demonstrate the use of plant materials and tools. F11.1

2 Apply basic design principles to products and designs. F11.2

3 Handle, prepare, and arrange cut flowers appropriately. F11.3

4 Develop a marketing and merchandising strategy to use in the floral industry. F11.4

. **Plant and Soil Science Pathway** G.

1 Apply plant classification principles. G1.0

1 Classify and identify plants by order, family, genus, and species. G1.1

2 Practice how to identify plants by using a dichotomous key. G1.2

3 Demonstrate how common plant parts are used to classify the plants. G1.3

4 Communicate the differences between, and uses of, native and nonnative plants. G1.4

5 Distinguish the differences between monocots and dicots. G1.5

6 Explain the differences between plants under production and weeds. G1.6

2 Explore cell biology. G2.0

1 Compare differences between prokaryotic cells and plant and animal eukaryotic cells and how viruses differ from them in complexity and general structure. G2.1

2 Test plant cellular function reactions when plants are grown under different conditions. G2.2

3 Explain functions organelles play in the health of the cell. G2.3

4 Recognize the part of the cell that is responsible for the genetic information that controls plant growth and development. G2.4

5 Summarize plant inheritance principles, including the structure and role of DNA. G2.5

6 List which organelles in plant cells carry out photosynthesis. G2.6

Skip to main content

3. Understand plant physiology and growth principles. G3.0
    1. Investigate plant systems, nutrient transportation, and energy storage. G3.1
    2. Label the seed's essential parts and describe their functions. G3.2
    3. Discern how primary, secondary, and trace elements are used in plant growth. G3.3
    4. Research the factors that influence plant growth, including water, nutrients, light, soil, air, and climate. G3.4
    5. Identify the tissues seen in a cross section of woody and herbaceous plants. G3.5
    6. Conduct experiment(s) testing the factors that affect plant growth and predict plant response. G3.6
4. Demonstrate an understanding of sexual and asexual reproduction of plants. G4.0
    1. Explain the different forms of sexual and asexual plant reproduction. G4.1
    2. Demonstrate the various techniques for successful plant propagation (e.g., budding, grafting, cuttings, and seeds). G4.2
    3. Use the proper sterile technique used in tissue culture. G4.3
5. Assess pest problems and management. G5.0
    1. Demonstrate how to categorize insects as pests, beneficial or neutral, and describe their roles. G5.1
    2. Explain the role of other pests, such as nematodes, molds, mildews, and weeds. G5.2
    3. Compare and contrast conventional, sustainable, and organic management methods to prevent or treat plant disease symptoms. G5.3
    4. Use integrated pest management to prevent, treat, and control plant disease symptoms (including conventional, sustainable, and organic management methods). G5.4
    5. Research how biotechnology can be used to manage pests. G5.5
6. Assess the role of soils in plant production. G6.0
    1. Understand soil types, soil texture, structure, and bulk density and explain the U.S. Department of Agriculture (USDA) soil-quality rating procedure. G6.1
    2. Analyze soil properties necessary for successful plant production, including pH, electrical conductivity (EC), and essential nutrients. G6.2
    3. Explain soil biology and diagram the cycles in nature as related to the soil food chain. G6.3
    4. Research how soil biology affects the environment and natural resources. G6.4

Skip to main content

7 Integrate effective tillage and soil conservation management practices. G7.0

1 Plan how to effectively manage and conserve soil through conventional, minimum, conservation, and no-tillage irrigation and through drainage and tillage practices. G7.1

2 Assess how global positioning systems, surveying, laser leveling, and other tillage practices conserve soil. G7.2

3 Use tools such as the USDA and the local Resource Conservation District soil survey maps to determine appropriate soil management practices. G7.3

8 Evaluate effective water management practices. G8.0

1 Summarize California water history, current issues, water rights, water law, and water transfer through different distribution projects throughout the state. G8.1

2 Research and describe the local, state, and federal agencies that regulate water quality and availability in California. G8.2

3 Define the definition of a watershed and explain how it is used to measure water quality. G8.3

4 Explain effective water management and conservation practices, including the use of tailwater ponds. G8.4

5 Use water-testing standards and perform bioassay and macro-invertebrate protocols to assess water quality. G8.5

9 Explain the concept of an "agrosystem" approach to production. G9.0

1 Identify and classify the plants and animals in an agricultural system (as producers, consumers, or decomposers). G9.1

2 Compare and contrast the elements of conventional, sustainable, and organic production systems. G9.2

3 Differentiate among the components of "whole-system management." G9.3

10 Apply local crop management and production practices. G10.0

1 Practice local cultural techniques, including monitoring, pruning, fertilization, planting, irrigation, harvest treatments, processing, and packaging practices for various tree, grain, hay, and vegetable classes. G10.1

2 Explain common marketing and shipping characteristics of local commodities. G10.2

3 Interpret general maturity and harvest-time guidelines for specific local plant products. G10.3

4 Apply point-of-origin safety and sanitation procedures in the production, harvesting, handling, processing, and storing of edible plant products. G10.4

Skip to main content

11 Demonstrate competence in applications of scientific principles and techniques in plant science. G11.0

0 Research how changing technology, such as micro-propagation, biological pest controls, and genetic engineering (including DNA extraction and gel electrophoresis), affects plant production, yields, and management. G11.0

2 Explain the various technology advancements that affect plant and soil science, such as global positioning systems, global information systems, variable rate technology, and remote sensing. G11.2

3 Assess how herbicide-resistant plant genes can affect the environment. G11.3

4 Communicate how genetic engineering techniques have been used to improve crop yields. G11.4

5 Compare and contrast 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. G11.5