



Test Framework

Agriculture (320)

May 2023

Content Domain	Range of Competencies	Approximate Percentage of Test Score
I. Plant, Soil, and Ecological Sciences	0001–0003	30%
II. Animal Science	0004–0005	20%
III. Agricultural Business, Economics, and Marketing	0006–0008	20%
IV. Agricultural Mechanics and Technology	0009–0010	15%
V. Agricultural Education Program and Career Development	0011–0012	15%

PLANT, SOIL, AND ECOLOGICAL SCIENCES

0001: Apply knowledge of plant taxonomy, anatomy, physiology, reproduction, and genetics.

- Demonstrate knowledge of the classification and characteristics of major plant and tree groups that are of agricultural significance (e.g., monocots, dicots).
- Apply knowledge of the structures and functions of cells, tissues, and systems of plants and of plant physiological processes, including trees.
- Apply knowledge of the processes of photosynthesis, respiration, and transpiration in plants and trees.
- Analyze factors that influence plant and tree growth and maturation (e.g., light, temperature, day length, water, nutrients, hormones).
- Demonstrate knowledge of asexual and sexual reproduction in plants and trees, the advantages and disadvantages of each, and the structures that are involved in the process.
- Apply knowledge of methods and techniques of asexual and sexual plant and tree propagation (e.g., cutting, rooting, grafting, layering, dividing, air layering) and the advantages and disadvantages of each.
- Apply knowledge of principles of inheritance and genetics and the use of these principles in selective breeding and hybridization of plants and trees.

0002: Apply knowledge of the influence of agriculture on the environment and of the principles of soil science, ecology, and natural resources management.

- Demonstrate knowledge of soil classification, characteristics, components (e.g., humus, sand, clay), and properties (e.g., texture, particle size, porosity) and their relevance to agricultural production.
- Apply knowledge of the suitability of different soils for various crops, procedures for performing and interpreting soil tests, and the types and uses of various soil amendments (e.g., lime, organic matter, types and formulations of fertilizers).
- Apply knowledge of principles and methods of soil management, conservation, and erosion control (e.g., cover cropping, crop rotation, minimum tillage), including various types of tillage and their uses in agricultural production.
- Demonstrate knowledge of basic ecological principles (e.g., niche, ecosystem, food chains, succession) and their relevance to agriculture.
- Demonstrate knowledge of energy and biogeochemical cycles and their relevance to agriculture.
- Apply knowledge of types and characteristics of renewable and nonrenewable natural resources, including energy resources, their relevance to agriculture, and principles and methods for their sustainable use.
- Demonstrate knowledge of the effects of various types of agricultural production systems (e.g., monoculture, polyculture) on the environment; strategies for preventing, minimizing, and mitigating environmental degradation due to agricultural production; and understanding the introduction and spread of invasive species.
- Apply knowledge of principles and methods of forest, wildlife, and habitat conservation, grazing, and management, including Best Management Practices (BMPs).
- Apply knowledge of social, legal, ethical, and safety issues related to agriculture and the environment.

0003: Apply knowledge of plant production systems, plant nutrition, and plant pests and diseases.

- Demonstrate knowledge of species, varieties, and characteristics of different types of crops (e.g., field, fruit, trees, horticultural, greenhouse, nursery).
- Apply knowledge of practices, methods, and technologies for planting, growing, and harvesting agriculturally important crops (e.g., hydroponics, row crops, mechanical harvesting, hand harvesting, terracing, crop rotation, intercropping).
- Demonstrate knowledge of conventionally and unconventionally grown crops (e.g., genetically engineered, vertically grown, organic) and the advantages and disadvantages of each.
- Apply knowledge of the function of important plant nutrients, sources of nutrients, and nutrient deficiency symptoms in plants.
- Apply knowledge of types of common diseases of plants, their causes and symptoms, and methods for their prevention and control (e.g., planting resistant varieties, roguing diseased plants, controlling vectors).
- Apply knowledge of types and characteristics of common plant pests and toxic plants, including signs of the damage they produce and methods for their control (e.g., chemical pesticides, integrated pest management, intercropping).
- Apply knowledge of methods for the control of weeds (e.g., mulching, herbicides, tillage) in field, fruit, and horticultural crops.
- Demonstrate knowledge of procedures for processing, storing, and grading plant products, including laws related to the inspection of various products.
- Demonstrate knowledge of greenhouse and nursery systems (e.g., facilities, watering systems, growth media), principles and methods for growing greenhouse and nursery crops, and designing and managing landscapes.

ANIMAL SCIENCE

0004: Apply knowledge of the taxonomy, anatomy, physiology, reproduction, and genetics of animals.

- Demonstrate knowledge of the characteristics and uses of various species and breeds of agriculturally important animals (e.g., fish, livestock, poultry), including nontraditional animals (e.g., buffalo, ostriches).
- Demonstrate knowledge of principles for evaluating and selecting domestic animals, and the criteria that are used for evaluating individual animals of species used in various production systems.
- Apply knowledge of the cells, tissues, and organ systems of animals; the relationships of their structures to their functions; and the characteristics of physiological processes (e.g., digestion, excretion, respiration) in animals, including toxin production and defense mechanisms.
- Demonstrate knowledge of growth processes in animals, factors that influence the growth of animals, and the stages and timing of growth and maturation in various species of domestic animals.
- Apply knowledge of animal reproduction; breeding practices in various species of domestic animals; and the handling and care of female animals during pregnancy and parturition, including the handling and care of newborn and infant animals in their first weeks of life.
- Apply knowledge of principles of inheritance and genetics (e.g., Punnett squares, heritability of traits) and the application of these principles in selective breeding and hybridization of domestic animals.

0005: Apply knowledge of animal production systems, animal nutrition, and animal diseases and parasites.

- Demonstrate knowledge of types and characteristics of production systems for a variety of animal products (e.g., beef, pork, wool, fish, eggs) and the types, characteristics, and management of animal facilities.
- Demonstrate knowledge of procedures used in animal production (e.g., dehorning, castrating), practices for safe and humane handling of animals, and legal and ethical issues related to animal production.
- Demonstrate knowledge of procedures for the safe handling, processing, and grading of animal products, including laws related to the inspection of various products.
- Apply knowledge of the effects of animal production on the environment (e.g., overgrazing, pollution of surface water with wastes, release of methane from feedlots) and methods for preventing, minimizing, and mitigating these effects.
- Apply knowledge of functions, requirements, sources, and deficiency symptoms of various nutrients (e.g., protein, vitamins, minerals) and energy requirements for various species of domestic animals.
- Apply knowledge of types, composition, nutrients, and energy content of common animal feeds (e.g., concentrates, roughages); purposes of common feed additives; toxicity of different feed components; and variation in feeding practices related to animal life cycles (e.g., maintenance, growth, pregnancy, lactation).
- Apply knowledge of types and characteristics of common infectious and noninfectious animal diseases (e.g., livestock, wildlife, companion domestic species); their causes and symptoms; and methods for their prevention, treatment, and control (e.g., vaccination, sanitation, antibiotics).
- Apply knowledge of types and characteristics of common parasites of domestic animals (e.g., livestock, wildlife, companion domestic species); their life cycles; the symptoms that they cause; and methods for their prevention, treatment, and control.

AGRICULTURAL BUSINESS, ECONOMICS, AND MARKETING

0006: Apply knowledge of agricultural business ownership and business management.

- Demonstrate knowledge of the diversity of agricultural products and services and the types and characteristics of large and small agricultural businesses (e.g., plant and animal production, retail and wholesale supply and service providers, Internet businesses).
- Demonstrate knowledge of types and characteristics of business ownership (e.g., sole proprietorship, S corporation, partnership) and other models of business organization (e.g., franchising, joint ventures, licensing).
- Demonstrate knowledge of management functions (e.g., planning, organizing, controlling) in agricultural businesses and characteristics of business leadership.
- Apply knowledge of the role and importance of entrepreneurship in agricultural businesses, characteristics of successful entrepreneurs, advantages and disadvantages of owning an agricultural business, and steps and strategies for starting an agricultural business.
- Demonstrate knowledge of strategies of risk management in agricultural businesses (e.g., diversification, hedging); principles of financial planning and management; basic banking procedures; and uses, sources, types, and costs of credit in agricultural businesses.
- Apply knowledge of principles and procedures of human resources management in agricultural businesses (e.g., hiring, evaluating, and terminating employees) and factors that influence individual and group behavior and employee motivation and morale.
- Demonstrate knowledge of laws and policies that affect various aspects of management of agricultural businesses (e.g., human resources, record keeping and reporting, business ownership).

0007: Apply knowledge of principles of marketing and their application to agricultural businesses.

- Demonstrate knowledge of the marketing mix, marketing strategies (e.g., market segmentation), components of a marketing plan (e.g., product, price, promotion, placement), and strategies for developing a marketing plan (e.g., conducting market research, identifying target markets).
- Apply knowledge of steps in product development and factors affecting the development, commercialization, and sale of agricultural products (e.g., value-added principles, competitive landscape, product features, development and marketing costs).
- Apply knowledge of product pricing strategies in marketing agricultural products (e.g., penetration pricing, price skimming, premium pricing) and the difference between price and non-price-marketing strategies.
- Apply knowledge of promotional strategies in marketing agricultural products (e.g., advertising, sales promotion, use of loss leaders, direct marketing, social media).
- Demonstrate knowledge of strategies, issues, and trends in the marketing of agricultural products over the Internet (e.g., developing a Web site, listing on search engines, providing security).
- Demonstrate knowledge of strategies, issues, and trends in the global marketing of agricultural products (e.g., cultural preferences, language barriers, differences in foreign and U.S. laws and policies).
- Apply knowledge of consumer behavior and motivation; customer relations; and steps, strategies, and issues in the selling of agricultural products.
- Demonstrate knowledge of laws and regulations relating to the marketing of agricultural products (e.g., laws related to consumer protection, product labeling, truth in advertising, price gouging, bait-and-switch promotion).

0008: Apply knowledge of principles of economics and their application to agricultural businesses.

- Demonstrate knowledge of basic economic principles (e.g., supply and demand, competition, opportunity cost) and their application to agricultural businesses.
- Demonstrate knowledge of types and characteristics of economic systems (e.g., command, traditional, market), market structures (e.g., monopoly, oligopoly), and factors that affect the operation of market economies (e.g., marketing, supply and demand, consumer choice, grants).
- Apply knowledge of factors that affect productivity in businesses involved in agricultural production (e.g., specialization, economies of scale, diminishing returns, innovation).
- Apply knowledge of macroeconomic factors that affect agricultural businesses (e.g., recession, employment levels, inflation) and the use of economic indicators (e.g., gross domestic product [GDP], consumer price index [CPI]) to assess these factors.
- Apply knowledge of how government tax, regulation, spending, and monetary and fiscal policies affect agricultural businesses, including tax credits.
- Demonstrate knowledge of how global factors (e.g., comparative advantage, supply chain issues, international competition, government policies) affect U.S. agriculture.
- Demonstrate knowledge of the importance of international trade for U.S. agriculture and factors that affect trade (e.g., tariffs, subsidies, exchange rates), including the roles that international agencies (e.g., World Bank, International Monetary Fund) and trade agreements (e.g., United States–Mexico–Canada Agreement) play in U.S. agriculture.

AGRICULTURAL MECHANICS AND TECHNOLOGY

0009: Apply knowledge of mechanical principles and the characteristics, components, and uses of agricultural power equipment.

- Apply knowledge of mechanical principles (e.g., force, work, power) and mechanical systems (e.g., levers, pulleys, gears) of agricultural power equipment.
- Calculate basic units of agriculture related to production (e.g., right triangles, Pythagorean theorem, scaling up or down, slope), including international system (SI) and imperial units (e.g., cords, acres, gallons per minute, pounds per square inch [PSI]).
- Demonstrate knowledge of types, characteristics, components, and uses of agricultural equipment (e.g., combines, swathers, mowers, balers, chainsaws, skidders, drills, handheld equipment).
- Demonstrate knowledge of types (e.g., two-stroke cycle, four-stroke cycle, diesel), characteristics, components (e.g., crankshaft, camshaft, carburetor), and principles of operation of internal combustion engines and related power systems (e.g., power take-offs).
- Apply knowledge of principles, tools, and methods for maintaining, servicing, and repairing agricultural power equipment.
- Apply knowledge of principles and practices for the safe operation and maintenance of agricultural power equipment and machinery, including understanding personal protection equipment (PPE).
- Demonstrate knowledge of basic principles of hydraulics (e.g., noncompressible fluids) and electricity and the types, characteristics, components, operating principles, and uses of electrical and hydraulic systems used in agricultural power equipment.

0010: Apply knowledge of the design and construction of agricultural structures and systems and the use of technology in agriculture.

- Apply knowledge of principles of building design and basic project, planning, and measurement skills (e.g., selecting sites, estimating costs, interpreting blueprints, installing ventilation systems) to the construction of agricultural structures.
- Demonstrate knowledge of basic construction principles and the techniques, methods, materials, tools, and equipment used in the construction of agricultural structures.
- Apply knowledge of the properties and agricultural uses of commonly used metals, basic principles, techniques, HVAC, and tools used for metal fabrication (e.g., cutting, drilling, shaping, joining) and procedures to ensure safety in metal fabrication.
- Apply knowledge of basic principles, techniques, materials, and tools used in carpentry, woodworking, and finishing and procedures to ensure safety when engaging in these tasks.
- Demonstrate knowledge of basic principles, techniques, materials, and tools used in the installation and maintenance of electrical systems in agricultural structures, including the design, components, and operation of electrical circuits and devices (e.g., motors, batteries, sensors, wiring, control and safety devices).
- Demonstrate knowledge of basic plumbing methods, tools, and materials and the types, components, uses, and the advantages and disadvantages of irrigation systems used in agricultural systems.
- Demonstrate knowledge of applications of technology in agricultural production (e.g., precision farming, environmental control in greenhouses and other facilities, formulating rations) and of technological systems (e.g., remote sensing, laser-guided tilling, geographic information systems [GIS]) used to accomplish these applications.
- Demonstrate knowledge of applications of biotechnology in agriculture (e.g., herbicide resistance, increased milk production, increased growth rates of salmon); principles, methods, and techniques used in biotechnology; and social, economic, and environmental issues concerning the use of biotechnology in agriculture.

AGRICULTURAL EDUCATION PROGRAM AND CAREER DEVELOPMENT

0011: Apply knowledge of the three-component agricultural education program model, the National FFA Organization, and communication and leadership skills in agricultural education.

- Demonstrate knowledge of the three-component agricultural education program model and the intra-educational relationships between classroom and laboratory learning, supervised agricultural experiences (SAEs), and participation in the National FFA Organization in a total program approach to agricultural education.
- Apply knowledge of principles and practices of leadership, teamwork, and communication and strategies for motivating and fostering these skills among students.
- Demonstrate knowledge of purposes and goals of the National FFA Organization and the role of student FFA chapters in assisting students in developing leadership, communication, citizenship, teamwork, and competitive skills.
- Demonstrate knowledge of organizational structures of the local, state, and national FFA, the roles of officers in an FFA chapter, and the rules of basic parliamentary procedure.
- Apply knowledge of the importance of community service in FFA, its relationship to an FFA chapter's Program of Activities (POA), and strategies for assisting students in the development of a POA for their chapter.
- Apply knowledge of state and national competitive events in FFA and strategies for facilitating student participation in these events (e.g., LDE, CDE, Proficiency awards, degrees) at the state and national levels.
- Apply knowledge of the roles and responsibilities of faculty advisors to a student FFA chapter and strategies for obtaining support for an FFA chapter at the school, district, and community levels.

0012: Apply knowledge of agricultural careers, career development, and the role of supervised agricultural experiences in preparing students for a career in agriculture-related fields.

- Demonstrate knowledge of the scope and diversity of agriculture-related careers and occupations and the knowledge and skills required for various agriculture-related careers.
- Demonstrate knowledge of employer expectations and the workplace skills and personal characteristics necessary for a successful career in agriculture-related fields (e.g., personal finance, interpersonal communication, time management).
- Demonstrate knowledge of methods of career exploration (e.g., job shadowing, internships, apprenticeships) and strategies for assisting students in their participation in career exploration and in conducting self-assessments as part of their career planning.
- Apply knowledge of strategies for assisting students in developing skills for locating and obtaining jobs in agriculture-related fields (e.g., conducting job searches, creating a résumé, interviewing for a job).
- Demonstrate knowledge of the goals and purposes of supervised agricultural experiences (SAEs) and the characteristics of different types of SAEs, including foundational and immersion (e.g., placement/internship, ownership/entrepreneurship, research, school-based enterprise, service learning).
- Apply knowledge of strategies for assisting students in planning and selecting SAEs and for creating SAE opportunities by establishing relationships between the agricultural education program and local businesses and community members.
- Apply knowledge of strategies and procedures for coordinating and supervising student SAEs and for assessing student learning during their SAEs.