The State Board of Education (SBOE) adopts amendments to §§127.49, 127.51, and 127.52, concerning Texas Essential Knowledge and Skills (TEKS) for career development and career and technical education (CTE) in agriculture, food, and natural resources. The amendments are adopted without changes to the proposed text as published in the August 1, 2025 issue of the *Texas Register* (50 TexReg 5031) and will not be republished. The amendments make a technical adjustment to the prerequisites for §127.49 to align with the CTE programs of study; update cross references; and update language relating to employability skills to reference new 19 TAC §127.15.

REASONED JUSTIFICATION: The federal *Strengthening Career and Technical Education for the 21st Century Act*, commonly referred to as Perkins V, requires states that receive federal CTE funds to align CTE programs of study to high-wage, in-demand, and high-skill occupations. In fall 2023, the Texas Education Agency engaged members of the workforce, secondary education, and higher education to advise on the development and refresh of programs of study, which include coherent course sequences, industry-based certifications, and work-based learning opportunities to ensure students are prepared for high-wage, in-demand, and high-skill careers in Texas.

The amendments update language related to prerequisites and references to a course title to ensure alignment with refreshed programs of study. In addition, employability skills have been removed from the rules, and a reference to the universal employability skills in new §127.15 has been added.

The SBOE approved the amendments for first reading and filing authorization at its June 27, 2025 meeting and for second reading and final adoption at its September 12, 2025 meeting.

In accordance with Texas Education Code, §7.102(f), the SBOE approved the amendments for adoption by a vote of two-thirds of its members to specify an effective date earlier than the beginning of the 2026-2027 school year. The earlier effective date will allow for technical adjustments to be made to course prerequisites for implementation in the 2025-2026 school year. The effective date is 20 days after filing as adopted with the *Texas Register*.

SUMMARY OF COMMENTS AND RESPONSES: The public comment period on the proposal began August 1, 2025, and ended at 5:00 p.m. on September 2, 2025. The SBOE also provided an opportunity for registered oral and written comments at its September 2025 meeting in accordance with the SBOE board operating policies and procedures. Following is a summary of the public comments received and corresponding responses.

Comment. Twelve teachers expressed support for the amendment to the prerequisite for §127.49, Livestock and Poultry Production (One Credit), Adopted 2024.

Response. The SBOE agrees and took action to adopt the proposed amendment to §127.49 to make a technical adjustment to the prerequisite to align with the CTE programs of study.

Comment. A community member stated that the current prerequisite for Livestock and Poultry Production creates problems with the sequence of courses for almost all schools that use this popular course as part of an animal science program of study. The commenter expressed support for the proposed amendment.

Response. The SBOE agrees and took action to adopt the proposed amendment to §127.49 to make a technical adjustment to the prerequisite to align with the CTE programs of study.

Comment. An administrator requested the removal of the current prerequisite for the Livestock and Poultry Production course, which reads "a minimum of two credits with at least one course in a Level two or higher course from the Agriculture, Food, and Natural Resources Career Cluster." The commenter stated that this prerequisite makes it challenging to schedule and ensure that students are following the sequence of courses necessary to achieve completer status for a program of study.

Response. The SBOE agrees and took action to adopt the proposed amendment to §127.49 to make a technical adjustment to the prerequisite to align with the CTE programs of study.

STATUTORY AUTHORITY. The amendments are adopted under Texas Education Code (TEC), §7.102(c)(4), which requires the State Board of Education (SBOE) to establish curriculum and graduation requirements; TEC, §28.002(a), which identifies the subjects of the required curriculum; and TEC, §28.002(c), which requires the SBOE

to identify by rule the essential knowledge and skills of each subject in the required curriculum that all students should be able to demonstrate and that will be used in evaluating instructional materials and addressed on the state assessment instruments.

CROSS REFERENCE TO STATUTE. The amendments implement Texas Education Code, §7.102(c)(4) and §28.002(a) and (c).

<rule>

§127.49. Livestock and Poultry Production (One Credit), Adopted 2024.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2025-2026 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(2) of this chapter (relating to Career and Technical Education Employability Skills) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 10-12. Prerequisite: at least one course from the Agriculture, Food, and Natural Resources Career Cluster. Recommended prerequisite: Principles of Agriculture, Food, and Natural Resources. Students shall be awarded one credit for successful completion of this course.

(c) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Agriculture, Food, and Natural Resources Career Cluster focuses on the production, processing, marketing, distribution, financing, and development of agricultural commodities and resources, including food, fiber, wood products, natural resources, horticulture, and other plant and animal products/resources.

(3) In Livestock and Poultry Production, students acquire knowledge and skills related to the livestock and poultry production industry. Livestock and Poultry Production may address topics related to beef cattle, dairy cattle, swine, sheep, goats, and poultry. To prepare for careers in the field of animal science, students must attain academic knowledge and skills, acquire knowledge and skills related to livestock and poultry systems and the workplace, and develop knowledge and skills regarding career opportunities, entry requirements, and industry expectations. To prepare for success, students need opportunities to learn, reinforce, apply, and transfer their knowledge and skills in a variety of settings.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

(1) The student develops a supervised agricultural experience program. The student is expected to:

(A) plan, propose, conduct, document, and evaluate a supervised agricultural experience program as an experiential learning activity; and

(B) use appropriate record-keeping skills as they relate to the supervised agricultural experience program.

(2) The student develops leadership skills through participation in an agricultural youth organization. The student is expected to:

(A) participate in youth agricultural leadership opportunities;

(B) review and participate in a local program of activities; and

(C) create or update documentation of relevant agricultural experience such as community service, professional, or classroom experiences.

(3) The student analyzes the history, domestication, and selection of livestock and poultry. The student is expected to:

(A) research and describe the history, domestication, and evolution of livestock and poultry species;

(B) describe the impacts other industries such as entertainment, recreation and leisure, and exhibition of animals have on the livestock and poultry industry; and

(C) evaluate and select livestock and poultry breeds based on purpose and conformation.

(4) The student explains the anatomy and physiology of livestock and poultry species. The student is expected to:

(A) identify and explain the skeletal, muscular, respiratory, and circulatory systems of livestock and poultry;

(B) identify and interpret ranges for healthy livestock and poultry vital signs; and

(C) compare normal and abnormal behavior of livestock and poultry.

(5) The student determines nutritional requirements of livestock and poultry. The student is expected to:

(A) describe and compare the digestive systems of ruminant and non-ruminant animals;

(B) identify sources of nutrients and classes of feed for livestock and poultry;

(C) identify vitamins, minerals, and feed additives for livestock and poultry;

(D) formulate feed rations based on nutritional needs and economic factors for livestock and poultry;

(E) research and discuss feeding practices and feed quality issues for livestock and poultry;

(F) identify forage plants used for livestock grazing; and

(G) research and explain livestock and poultry grazing practices such as rotational grazing and deferred grazing.

(6) The student explains livestock and poultry genetics and reproduction. The student is expected to:

(A) describe and compare the reproductive systems of various livestock and poultry;

(B) identify and explain livestock and poultry breeding systems such as grading up, crossbreeding, linebreeding, and inbreeding;

(C) use Expected Progeny Differences (EPDs) to evaluate livestock production;

(D) research and explain current and emerging technologies in livestock and poultry reproduction such as cloning, embryo transfer, in vitro fertilization, and artificial insemination;

(E) use Punnett squares to predict phenotypes and genotypes of livestock offspring; and

(F) explain the relationship between body condition scores and reproductive efficiency for livestock and poultry.

(7) The student understands how livestock and poultry are affected by pests and diseases. The student is expected to:

(A) identify and describe how bacteria, fungi, viruses, genetics, and nutrition affect livestock and poultry health;

(B) identify signs, symptoms, and prevention of livestock and poultry diseases;

(C) identify parasites and explain the signs, symptoms, treatment, and prevention of livestock and poultry parasites; and

(D) calculate dosage and identify administration methods of livestock and poultry medications.

(8) The student analyzes the management skills needed for livestock and poultry production. The student is expected to:

(A) identify tools and equipment for safe handling and restraining of livestock and poultry and select the appropriate tools or equipment for such tasks and purposes;

(B) identify types and essential features of facilities for livestock and poultry such as housing, veterinary, and reproduction facilities;

(C) evaluate and describe industry practices such as dehorning, castrating, docking, and vaccinating and sire, dam, and newborn care to maximize the efficiency of livestock and poultry;

(D) explain and demonstrate methods of identifying ownership of livestock and poultry such as branding, ear tagging, ear notching, wing bands, and tattooing; and

(E) explain the use of technology such as aircraft, robotics, and smart irrigation in modern livestock and poultry production.

(9) The student examines the interrelationship of the factors impacting livestock and poultry production operations. The student is expected to:

(A) research and explain livestock and poultry biosecurity and waste management practices;

(B) create an effective financial management plan for a livestock and poultry production operation;

(C) analyze and discuss environmental regulations, governmental regulations, and animal welfare policies related to livestock and poultry production;

(D) analyze the United States Department of Agriculture (USDA) standards and guidelines for organic livestock and poultry production;

(E) analyze and describe the interrelationship between grain markets and the livestock and poultry industry;

(F) assess the impact of the United States livestock and poultry industry on world commodity markets;

(G) use charts, tables, data, or graphs to evaluate the efficiency of livestock and poultry production; and

(H) develop and present a livestock or poultry operation plan that includes health, reproduction, nutrition, and management practices necessary for maximum efficiency.

§127.51. Veterinary Science (One Credit), Adopted 2024.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2025-2026 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(2) of this chapter (relating to Career and Technical Education Employability Skills) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 11 and 12. Prerequisite: Equine Science, Small Animal Management, or Livestock and Poultry Production. Students shall be awarded one credit for successful completion of this course.

(c) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Agriculture, Food, and Natural Resources Career Cluster focuses on the production, processing, marketing, distribution, financing, and development of agricultural commodities and resources, including food, fiber, wood products, natural resources, horticulture, and other plant and animal products/resources.

(3) Veterinary Science covers topics relating to veterinary practices, including practices for large and small animal species. To prepare for careers in the field of animal science, students must attain academic knowledge and skills, acquire technical knowledge and skills related to animal systems and the workplace, and develop knowledge and skills regarding career opportunities, entry requirements, and industry expectations. To prepare for success, students need opportunities to learn, reinforce, apply, and transfer knowledge and skills and technologies in a variety of settings.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

(1) The student develops a supervised agricultural experience program. The student is expected to:

(A) plan, propose, conduct, document, and evaluate a supervised agricultural experience program as an experiential learning activity; and

(B) use appropriate record-keeping skills as they relate to the supervised agricultural experience program.

(2) The student develops leadership skills through participation in an agricultural youth organization. The student is expected to:

(A) participate in youth agricultural leadership opportunities;

(B) review and participate in a local program of activities; and

(C) create or update documentation of relevant agricultural experience such as community service, professional, or classroom experiences.

(3) The student understands safety and health practices associated with working in veterinary medicine. The student is expected to:

(A) explain the importance of safe practices such as handling, restraint, and proper use of tools and equipment when working with animals;

(B) identify and discuss transmission and prevention of zoonotic diseases in large and small animal species;

(C) describe sanitation methods to prevent the spread of pathogens and maintain asepsis in sterile environments;

(D) locate, interpret, and implement safety data sheets (SDS) for handling chemicals;

(E) demonstrate and explain safe usage of clinical tools and equipment; and

(F) perform proper disposal of sharps and biohazards.

(4) The student understands current topics, professional ethics, and laws that relate to veterinary medicine. The student is expected to:

(A) research and discuss historical events, trends, and issues that have impacted veterinary medicine;

(B) analyze topics related to veterinary medical ethics, including animal rights and animal welfare; and

(C) explain policies and procedures in veterinary medicine that reflect local, state, and federal laws.

(5) The student evaluates effective management approaches and marketing strategies to determine their importance to the success of veterinary practices such as clinics and hospitals. The student is expected to:

(A) describe how the human-animal bond impacts veterinary practices when working with clients and their animals;

(B) identify and demonstrate skills needed to communicate effectively with clients and veterinary professionals;

(C) identify marketing strategies and explain how marketing affects the success of a veterinary practice; and

(D) research and discuss how electronic technology such as computer programs, medical records, hospital-to-hospital communication, and tablets is used in a veterinary practice.

(6) The student communicates the importance of medical terminology, evaluates veterinary terms to discover their meanings, and demonstrates the ability to use terms correctly. The student is expected to:

(A) analyze Greek and Latin prefixes, suffixes, and roots to determine the meaning of veterinary terms;

(B) identify, pronounce, and spell veterinary terms appropriately; and

(C) use directional anatomy terms appropriately for large and small animal species.

(7) The student understands proper animal handling as it relates to characteristics and behavior. The student is expected to:

(A) identify animal breeds according to characteristics;

(B) identify and compare normal and abnormal behavior within and among various animal species; and

(C) identify and discuss correct handling and restraint protocols for large and small animal species such as muzzling, lateral recumbency, sternal recumbency, jugular venipuncture, and haltering.

(8) The student explains anatomy and physiology of animals. The student is expected to:

(A) identify the parts and functions of the skeletal, muscular, respiratory, circulatory, digestive, endocrine, and nervous systems for large and small animal species; and

(B) describe the interrelationships among animal body systems.

(9) The student determines the importance of animal nutrition in maintaining a healthy animal. The student is expected to:

(A) identify sources of nutrients and classes of feeds for large and small animal species;

(B) identify feed additives for large and small animal species and describe how additives affect the food supply;

(C) analyze dietary needs and feed-quality issues for large and small animal species and their effect on feeding practices; and

(D) research and compare the nutritional value of feeds such as prescription, commercial, homemade, fad, and raw diets for large and small animal species.

(10) The student evaluates an animal's health during a clinical examination. The student is expected to:

(A) describe the characteristics and signs of a healthy and an unhealthy animal;

(B) identify ranges for healthy vital signs for large and small animal species such as temperature, pulse, respiration, hydration, and capillary refill time;

(C) demonstrate the proper procedures for obtaining vital signs for large and small animal species and interpret vital sign measurements to determine the health of the animal;

(D) describe effects of age, stress, and environmental factors on vital signs of animals;

(E) explain procedures for physical examinations for large and small animal species;

(F) explain the anatomical regional approach to assess an animal's health;

(G) apply mathematical skills to calculate weight and linear body measurement for large and small animal species and to convert between measurement systems; and

(H) analyze tables, charts, and graphs to interpret large and small animal patient and clinical data.

(11) The student analyzes how diseases and parasites affect animal health. The student is expected to:

(A) describe the process of immunity and disease transmission for large and small animal species;

(B) identify and describe pathogens for large and small animal species and the diseases they cause;

(C) describe the effects that diseases have on various body systems for large and small animal species;

(D) identify parasites for large and small animal species using common and scientific names;

(E) describe life cycles of parasites found in large and small animal species;

(F) explain how parasites found in large and small animal species are transmitted and explain the effects on the host;

(G) describe parasitic diagnostic procedures for large and small animal species; and

(H) describe treatment protocols for parasites found in large and small animal species.

(12) The student examines various aspects of veterinary laboratory procedures. The student is expected to:

(A) explain the procedures used in collecting, handling, and preparing fecal, blood, and urine specimens for large and small animal species;

(B) explain veterinary procedures used in examining fecal, blood, and urine specimens; and

(C) analyze and compare normal and abnormal results obtained in veterinary laboratory procedures.

(13) The student analyzes technical veterinary procedures and skills. The student is expected to:

(A) explain the care, maintenance, and use of equipment and instruments found in veterinary practices;

(B) interpret and prepare a veterinary medical record, adhering to client and patient confidentiality;

(C) explain and demonstrate routine animal care skills such as administering medications, nail trimming, bathing, dipping, grooming, ear cleaning, expressing anal sacs, dental care, placing a tail tie, and ownership identification methods;

(D) explain and demonstrate therapeutic care for large and small animal species such as patient observation, maintaining and administering fluids, applying and removing bandages, removing sutures, caring for open wounds, and providing hydrotherapy physical therapy;

(E) describe emergency protocols and first aid procedures for large and small animal species, including cardiopulmonary resuscitation, control of bleeding, and signs of shock; and

(F) research and compare veterinary care of specialty patients, including newborns, orphans, geriatric animals, recumbent animals, and animals with disabilities.

(14) The student identifies and discusses surgical-assisting procedures and skills. The student is expected to:

(A) explain the veterinary protocol for pre-surgical and post-surgical care of a patient;

(B) identify tools and equipment used in veterinary surgical procedures;

(C) describe methods used in the preparation, sterilization, and opening of surgery packs; and

(D) describe veterinary surgical procedures such as spaying, castration, dehorning, docking, dental prophylaxis, and tooth extraction.

(15) The student identifies imaging equipment and understands how to safely operate and maintain equipment. The student is expected to:

(A) research and explain the parts and function of imaging equipment such as an ultrasonograph, endoscope, electrocardiograph, and radiograph;

(B) explain safety, maintenance, and operation procedures of imaging equipment;

(C) demonstrate patient restraint and positioning methods used for imaging purposes of large and small animal species; and

(D) differentiate between the images from various imaging equipment.

(16) The student identifies veterinary pharmacology procedures and skills. The student is expected to:

(A) identify veterinary medications according to their classification, schedule, form, routes of administration, and methods of administration;

(B) explain handling, storage, distribution, protocols, and laws for veterinary medications, including controlled substances;

(C) calculate dosage for large and small animal species using factors such as concentration of drug, weight of animal, and prescribed dosage;

(D) prepare a veterinary prescription label with identifiers that are required by the United States Food and Drug Administration;

(E) identify and explain the equipment and instruments used to safely administer medications for large and small animal species; and

(F) research and present emerging trends in veterinary pharmacology such as internet pharmacies, herbal supplements, organic labeling, and extra-label and off-label use of medications.

§127.52. Advanced Animal Science (One Credit), Adopted 2024.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2025-2026 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(2) of this chapter (relating to Career and Technical Education Employability Skills) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 11 and 12. Prerequisites: Biology and Chemistry or Integrated Physics and Chemistry (IPC); Algebra I and Geometry; and either Small Animal Management, Equine Science, or Livestock and Poultry Production. Recommended prerequisite: Veterinary Science. Students must meet the 40% laboratory and fieldwork requirement. This course satisfies a high school science graduation requirement. Students shall be awarded one credit for successful completion of this course.

(c) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Agriculture, Food, and Natural Resources Career Cluster focuses on the production, processing, marketing, distribution, financing, and development of agricultural commodities and resources, including food, fiber, wood products, natural resources, horticulture, and other plant and animal products/resources.

(3) Advanced Animal Science examines the interrelatedness of human, scientific, and technological dimensions of animal production, including canine, feline, bovine, equine, caprine, porcine, ovine, poultry, and lagomorpha production. Instruction is designed to allow for the application of scientific and technological aspects of animal science through field and laboratory experiences. To prepare for careers in the field of animal science, students must attain academic knowledge and skills, acquire knowledge and skills related to animal systems, and develop knowledge and skills regarding career opportunities, entry requirements, and industry standards. To prepare for success, students need opportunities to learn, reinforce, apply, and transfer their knowledge and skills in a variety of settings.

(4) Nature of science. Science, as defined by the National Academy of Sciences, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not scientifically testable.

(5) Scientific hypotheses and theories. Students are expected to know that:

(A) hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power that have been tested over a wide variety of conditions are incorporated into theories; and

(B) scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well established and highly reliable explanations, but they may be subject to change as new areas of science and new technologies are developed.

(6) Scientific inquiry. Scientific inquiry is the planned and deliberate investigation of the natural world using scientific and engineering practices. Scientific methods of investigation are descriptive, comparative, or experimental. The method chosen should be appropriate to the question being asked. Student learning for different types of investigations include descriptive investigations, which involve collecting data and recording observations without making

comparisons; comparative investigations, which involve collecting data with variables that are manipulated to compare results; and experimental investigations, which involve processes similar to comparative investigations but in which a control is identified.

(A) Scientific practices. Students should be able to ask questions, plan and conduct investigations to answer questions, and explain phenomena using appropriate tools and models.

(B) Engineering practices. Students should be able to identify problems and design solutions using appropriate tools and models.

(7) Science and social ethics. Scientific decision making is a way of answering questions about the natural world involving its own set of ethical standards about how the process of science should be carried out. Students should be able to distinguish between scientific decision-making methods (scientific methods) and ethical and social decisions that involve science (the application of scientific information).

(8) Science consists of recurring themes and making connections between overarching concepts. Recurring themes include systems, models, and patterns. All systems have basic properties that can be described in space, time, energy, and matter. Change and constancy occur in systems as patterns and can be observed, measured, and modeled. These patterns help to make predictions that can be scientifically tested, while models allow for boundary specification and provide tools for understanding the ideas presented. Students should analyze a system in terms of its components and how these components relate to each other, to the whole, and to the external environment.

(9) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(10) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

(1) Scientific and engineering practices. The student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models. The student is expected to:

(A) ask questions and define problems based on observations or information from text, phenomena, models, or investigations;

(B) apply scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems;

(C) use appropriate safety equipment and practices during laboratory, classroom, and field investigations as outlined in Texas Education Agency-approved safety standards;

(D) use appropriate tools such as dissection equipment, standard laboratory glassware, microscopes, various prepared slides, measuring devices, micropipettors, hand lenses, thermometers, hot plates, laboratory notebook, timing devices, cameras, Petri dishes, laboratory incubators, models, diagrams, and samples of biological specimens, syringes, needles, scalpels, microscopes slides, cover slips, artificial insemination equipment, and drench gun;

(E) collect quantitative data using the International System of Units (SI) and qualitative data as evidence;

(F) organize quantitative and qualitative data using calculators, computers, software, laboratory notebook, recordkeeping system, and reliable sources;

(G) develop and use models to represent phenomena, systems, processes, or solutions to engineering problems; and

(H) distinguish between scientific hypotheses, theories, and laws.

(2) Scientific and engineering practices. The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs. The student is expected to:

(A) identify advantages and limitations of models such as their size, scale, properties, and materials;

(B) analyze data by identifying significant statistical features, patterns, sources of error, and limitations;

(C) use mathematical calculations to assess quantitative relationships in data; and

(D) evaluate experimental and engineering designs.

(3) Scientific and engineering practices. The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The student is expected to:

(A) develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories;

(B) communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and

(C) engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence.

(4) Scientific and engineering practices. The student knows the contributions of scientists and recognizes the importance of scientific research and innovation on society. The student is expected to:

(A) analyze, evaluate, and critique scientific explanations and solutions by using empirical evidence, logical reasoning, and experimental and observational testing so as to encourage critical thinking by the student;

(B) relate the impact of past and current research on scientific thought and society, including research methodology, cost-benefit analysis, and contributions of diverse scientists as related to the content; and

(C) research and explore resources such as museums, libraries, professional organizations, private companies, online platforms, and mentors employed in a science, technology, engineering, and mathematics (STEM) field in order to investigate STEM careers.

(5) The student develops a supervised agricultural experience program. The student is expected to:

(A) plan, propose, conduct, document, and evaluate a supervised agricultural experience program as an experiential learning activity; and

(B) use appropriate record-keeping skills in a supervised agricultural experience program.

(6) The student develops leadership skills through participation in an agricultural youth organization. The student is expected to:

(A) participate in youth agricultural leadership opportunities;

(B) review and participate in a local program of activities; and

(C) create or update documentation of relevant agricultural experience such as community service, professional, or classroom experiences.

(7) The student analyzes the history, domestication, and evaluation of animals, including canine, feline, bovine, equine, caprine, porcine, ovine, poultry, and lagomorphs. The student is expected to:

(A) research and describe the history, including evolution, domestication, and introduction of species to countries, of canine, feline, bovine, equine, caprine, porcine, ovine, poultry, and lagomorphs;

(B) analyze and describe how changes in the global food market impact the animal production industry; and

(C) evaluate breeds of canine, feline, bovine, equine, caprine, porcine, ovine, poultry, and lagomorph based on purpose and conformation.

(8) The student defines how an organism grows and how specialized cells, tissues, and organs develop. The student is expected to:

(A) compare cells to show specialization of structure and function;

(B) explain cell division, including mitosis and meiosis;

(C) explain cell differentiation in the development of tissues and organs; and

(D) identify and explain the biological levels of organization in animals.

(9) The student examines and compares anatomy and physiology in animals. The student is expected to:

(A) compare the external anatomy of canine, feline, bovine, equine, caprine, porcine, ovine, poultry, and lagomorphs;

(B) identify the anatomical structures and physiological functions of the skeletal, muscular, circulatory, genitourinary, respiratory, nervous, immune, and endocrine systems of canine, feline, bovine, equine, caprine, porcine, ovine, poultry, and lagomorphs; and

(C) investigate and describe the interrelationship among animal body systems.

(10) The student understands the anatomical structures and physiological functions of the digestive system to determine nutritional requirements of ruminant and non-ruminant animals. The student is expected to:

(A) describe the structures and functions of the digestive systems of canine, feline, bovine, equine, caprine, porcine, ovine, poultry, and lagomorphs;

(B) identify and describe sources of nutrients and classes of feeds for canine, feline, bovine, equine, caprine, porcine, ovine, poultry, and lagomorphs;

(C) identify and describe the feed additives and supplements used to meet the nutritional requirements of canine, feline, bovine, equine, caprine, porcine, ovine, poultry, and lagomorphs;

(D) formulate rations based on different nutritional requirements, including age, gestation, lactation, sex, and purpose, for canine, feline, bovine, equine, caprine, porcine, ovine, poultry, and lagomorphs;

(E) analyze feeding practices in relation to nutritional requirements, including age, gestation, lactation, sex, and purpose, for canine, feline, bovine, equine, caprine, porcine, ovine, poultry, and lagomorphs;

(F) analyze feed quality issues and determine their effect on the health of canine, feline, bovine, equine, caprine, porcine, ovine, poultry, and lagomorphs;

(G) research and compare the nutritional value of feeds for all species discussed;

(H) identify forage plants used for livestock grazing and analyze the protein levels of each; and

(I) research grazing practices such as rotational grazing and deferred grazing and explain the advantages and disadvantages of each using the scientific and engineering design process.

(11) The student understands the principles of molecular genetics and heredity. The student is expected to:

(A) explain Mendel's laws of inheritance and predict genotypes and phenotypes of offspring using a Punnett square;

(B) use a Punnett square and assign alleles to justify genotype and phenotype predictions;

(C) identify the parts of the nucleotide and differentiate between the nucleotides found in deoxyribonucleic acid (DNA) and ribonucleic acid (RNA); and

(D) explain the functions of DNA and RNA.

(12) The student applies the principles of reproduction and breeding to animal improvement. The student is expected to:

(A) describe and compare reproductive anatomy of canine, feline, bovine, equine, caprine, porcine, ovine, poultry, and lagomorphs;

(B) analyze and compare reproductive cycles and phases of canine, feline, bovine, equine, caprine, porcine, ovine, poultry, and lagomorphs;

(C) correlate the reproductive cycles and phases to animal behavior;

(D) research breeding systems, including grading up, crossbreeding, linebreeding, and inbreeding, and explain the advantages and disadvantages of each using the scientific and engineering design process; and

(E) research breeding methods, including embryo transfer, artificial insemination, and natural mating, and explain the advantages and disadvantages of each using the scientific and engineering design process.

(13) The student analyzes how diseases and parasites affect animal health. The student is expected to:

(A) examine how factors such as geographic location, age, genetic composition, and inherited diseases influence the health of canine, feline, bovine, equine, caprine, porcine, ovine, poultry, and lagomorphs;

(B) describe the process of immunity and disease transmission of canine, feline, bovine, equine, caprine, porcine, ovine, poultry, and lagomorphs;

(C) identify and describe pathogens and the diseases they cause in canine, feline, bovine, equine, caprine, porcine, ovine, poultry, and lagomorphs;

(D) describe the effects that diseases have on various body systems of canine, feline, bovine, equine, caprine, porcine, ovine, poultry, and lagomorphs;

(E) research and explain the methods of prevention and control for diseases of canine, feline, bovine, equine, caprine, porcine, ovine, poultry, and lagomorphs;

(F) identify parasites of canine, feline, bovine, equine, caprine, porcine, ovine, poultry, and lagomorphs using common and scientific names;

(G) describe the life cycles of various parasites and relate them to animal health issues;

(H) explain how parasites are transmitted and the effect they have on canine, feline, bovine, equine, caprine, porcine, ovine, poultry, and lagomorphs;

(I) conduct or simulate parasite diagnostic tests; and

(J) explain the methods of prevention, control, and treatment of parasites of canine, feline, bovine, equine, caprine, porcine, ovine, poultry, and lagomorphs.

(14) The student discusses livestock market readiness and harvesting methods. The student is expected to:

(A) explain the stages of animal growth and development and how they relate to market readiness;

(B) evaluate market class and grades of livestock;

(C) compare harvesting methods for various species using the scientific and engineering design process;

(D) research and describe federal and state meat inspection standards such as safety, hygiene, and quality control standards;

(E) identify wholesale and retail cuts of meat and correlate to major muscle groups; and

(F) research animal by-products and explain their impact on society.

(15) The student explores methods of marketing animals and animal products. The student is expected to:

(A) compare various methods of animal marketing such as auction, contract sales, private treaty, internet sales, value-based, and exhibition of various animals;

(B) describe methods of marketing animal products such as farmers market, direct sales, wholesale, and retail;

(C) research and evaluate the effectiveness of various strategies and campaigns to market animal products based on consumption patterns and consumer preferences; and

(D) research and evaluate the effectiveness of various labeling options to market animal products such as organic, farm-raised, hormone-free, cage-free, grass-fed, antibiotic-free, and non-GMO labels based on consumption patterns and consumer preferences.

(16) The student demonstrates an understanding of policies and current issues in animal science. The student is expected to:

(A) investigate and discuss the use of biotechnology and biosecurity in the animal science industry;

(B) identify governmental regulations and policies such as environmental and animal welfare and research the impacts on animal production; and

(C) identify and research a current issue in scientific animal agriculture and design a protocol to address the issue using the scientific and engineering design process.