AHVS Expanded Lesson Review

The following is a compiled listing of the concepts, performance objectives, standards alignment, and essential questions by lesson.

Lesson 1.1 Biosecurity

Concepts	Performance Objectives
Students will know and understand	*Students will learn concepts by doing*
1. Removing and restricting pathogens prevents infection and disease of patients and handlers.	• Model antiseptic handwashing procedures. (Activity 1.1.1)
2. Organization and record-keeping are important to the success of an agricultural business.	• Students organize an Agriscience Notebook to organize coursework. (Activity 1.1.2)
3. Procedures and personal protective equipment protect animal health workers.	• Assess scenarios for safety hazards and determine proper personal protective equipment. (Activity 1.1.3) • Practice donning and doffing gloves. (Activity 1.1.4) • Demonstrate surgical gowning and gloving. (Activity 1.1.5)
4. Biosecurity protects animals and people from zoonotic diseases.	• Research a zoonotic disease and create an educational guide highlighting biosecurity. (Project 1.1.6)

National AFNR Content Standards Alignment

Career Ready Practices Content Standards	
CRP.04. Communicate clearly, effectively and with reason.	**Measure**
• CRP.04.01. Communicate using strategies that ensure clarity, logic, purpose and professionalism in formal and informal settings.	• Intermediate
• CRP.04.02. Produce clear, reasoned, and coherent written and visual communication in formal and informal settings.	• Intermediate
• CRP.04.03. Model active listening strategies when interacting with others in formal and informal settings.	• Intermediate
CRP.05. Consider the environmental, social and economic impacts of decisions.	**Measure**
• CRP.05.01. Assess, identify, and synthesize the information and resources needed to make decisions that positively impact the workplace and community.	• Advanced
• CRP.05.02. Make, defend, and evaluate decisions at work and in the community using information about the potential environmental, social, and economic impacts.	• Advanced
CRP.08. Utilize critical thinking to make sense of problems and persevere in solving them.	**Measure**
• CRP.08.01. Apply reason and logic to evaluate workplace and community situations from multiple perspectives.	• Advanced
• CRP.08.02. Investigate, prioritize and select solutions to solve problems in the workplace and community.	• Advanced

Animal Systems Career Pathway Content Standards	
AS.02. Utilize best-practice protocols based upon animal behaviors for animal husbandry and welfare.	**Measure**
• AS.02.01. Explain management techniques that ensure animal welfare.	• Intermediate
AS.07. Apply principles of effective animal health care.	**Measure**

• AS.07.01. Design programs to prevent animal diseases, parasites, and other disorders and ensure animal welfare.	• Advanced
• AS.07.02. Analyze biosecurity measures utilized to protect the welfare of animals and health of humans on a local, state, national, and global level.	• Advanced

Biotechnology Systems Career Pathway Content Standards	
BS.03: Demonstrate the application of biotechnology to solve problems in AFNR systems (e.g., bioengineering, food processing, waste management, horticulture, forestry, livestock, crops, etc.).	**Measure**
• BS.03.04: Apply biotechnology principles, techniques and processes to enhance plant and animal care and production (e.g., selective breeding, pharmaceuticals, biodiversity, etc.).	• Advanced

Common Core State Standards for English Language Arts

CCSS: English Language Arts Standards » Science & Technical Subjects » Grade 11-12	
Key Ideas and Details	• **RST.11-12.3 –** Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

Essential Questions

1. How are aseptic and sterile different?
2. How does proper handwashing contribute to disease prevention?
3. What are the key components that highlight the relevance of hygiene?
4. What strategies can help individuals maintain an organized notebook?
5. How does the organization of a notebook impact your ability to access and utilize information efficiently over time?
6. Why is surgical hygiene emphasized?
7. What is the significance of performing surgical gowning protocols properly?
8. How do biosecurity measures help prevent disease transmission?
9. How can biosecurity safeguard animal welfare?
10. What are some potential consequences of not implementing biosecurity measures?
11. How does biosecurity relate to public health?

Lesson 1.2 Terms and Techniques

Concepts	**Performance Objectives**
Students will know and understand	*Students will learn concepts by doing*
1. Animal health professionals utilize specific tools for the care and management of animals.	• Identify standard veterinary equipment. (Activity 1.2.1)
2. Maintaining aseptic techniques reduce the likelihood of pathogens spreading.	• Analyze the cleanliness of equipment before and after standard cleaning procedures. (Activity 1.2.2) • Practice packing, wrapping, and unwrapping a surgical pack. (Activity 1.2.3)
3. Animal health professionals use common medical prefixes, roots, and suffixes.	• Learn Latin medical words and their application in animal health care. (Activity 1.2.4)

4. Animal health professionals use medical abbreviations in charting and recordkeeping.	• Decode common medical abbreviations and use them to translate medical conversations. (Activity 1.2.5)

National AFNR Content Standards Alignment

Career Ready Practices Content Standards	
CRP.02. Apply appropriate academic and technical skills.	**Measure**
• CRP.02.01. Use strategic thinking to connect and apply academic learning, technical knowledge, and skills to solve problems in the workplace and community.	• Beginning • Intermediate • Advanced
CRP.04. Communicate clearly, effectively and with reason.	**Measure**
• CRP.04.01. Communicate using strategies that ensure clarity, logic, purpose and professionalism in formal and informal settings.	• Advanced

Animal Systems Career Pathway Content Standards	
AS.02. Utilize best-practice protocols based upon animal behaviors for animal husbandry and welfare.	**Measure**
• AS.02.01. Explain management techniques that ensure animal welfare.	• Advanced
AS.07. Apply principles of effective animal health care.	**Measure**
• AS.07.02. Analyze biosecurity measures utilized to protect the welfare of animals and health of humans on a local, state, national, and global level.	• Advanced

Biotechnology Systems Career Pathway Content Standards	
BS.02: Demonstrate proficiency by safely applying appropriate laboratory skills to complete tasks in a biotechnology research and development environment (e.g., standard operating procedures, record keeping, aseptic technique, equipment maintenance, etc.).	**Measure**
• BS.02.02: Implement standard operating procedures for the proper maintenance, use and sterilization of equipment in a laboratory.	• Advanced
• BS.02.03: Apply standard operating procedures for the safe handling of biological and chemical materials in a laboratory.	• Intermediate
• BS.02.04: Safely manage and dispose of biological materials, chemicals and wastes according to standard operating procedures.	• Intermediate
BS.03: Demonstrate the application of biotechnology to solve problems in AFNR systems (e.g., bioengineering, food processing, waste management, horticulture, forestry, livestock, crops, etc.).	**Measure**
• BS.03.04: Apply biotechnology principles, techniques and processes to enhance plant and animal care and production (e.g., selective breeding, pharmaceuticals, biodiversity, etc.).	• Advanced

Common Core State Standards for English Language Arts

CCSS: English Language Arts Standards » Science & Technical Subjects » Grade 11-12	
Key Ideas and Details	• **RST.11-12.1 –** Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. • **RST.11-12.3 –** Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
Craft and Structure	• **RST.11-12.4 –** Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.

Essential Questions

1. What are the similarities and differences between veterinary equipment?
2. What criteria would you use to check if the equipment is clean before and after cleaning?

3. How does proper equipment care impact animal health care?
4. What steps ensure thorough cleaning of various types of equipment in a veterinary setting?
5. What are the key steps in wrapping and unwrapping a surgical pack?
6. How does wrapping a surgical pack influence the efficiency of a surgical procedure?
7. What are protocols and procedures that help maintain a sterile field?
8. How are Latin terms used in animal health?
9. How do you ensure accurate translation in medical conversations by decoding abbreviations?
10. How does understanding abbreviations improve communication in a medical setting?

Lesson 2.1 Physiology and Profession

Concepts	Performance Objectives
Students will know and understand	*Students will learn concepts by doing*
1. Roles and responsibilities of animal care vary depending on an individual's level of education and professional certification.	• Categorizes tasks of different animal health care professionals and animal owners. (Activity 2.1.1)
2. Animal systems are codependent and specific symptoms can be indicators of illness or injury to a system.	• Research common symptoms for each body symptom. (Activity 2.1.2) • Map each body system in an anatomy book. (Activity 2.1.3)
3. Using industry-recognized terminology allows for clear communication between professionals.	• Practice identifying and labeling anatomical planes on a stuffed animal. (Activity 2.1.4)
4. People utilize multiple forms of verbal and nonverbal communication. 5. Empathy is a component of effective animal health care.	• Practice different forms of verbal and nonverbal professional communication. (Activity 2.1.5)
6. Animal health is an interdisciplinary field.	• Explore animal health careers to benefit a scenario. (Project 2.1.6)

National AFNR Content Standards Alignment

Career Ready Practices Content Standards	
CRP.02. Apply appropriate academic and technical skills.	**Measure**
• CRP.02.01. Use strategic thinking to connect and apply academic learning, technical knowledge, and skills to solve problems in the workplace and community.	• Intermediate
CRP.04. Communicate clearly, effectively and with reason.	**Measure**
• CRP.04.02. Produce clear, reasoned, and coherent written and visual communication in formal and informal settings.	• Intermediate
CRP.05. Consider the environmental, social and economic impacts of decisions.	**Measure**
• CRP.05.01. Assess, identify, and synthesize the information and resources needed to make decisions that positively impact the workplace and community.	• Intermediate
• CRP.05.02. Make, defend, and evaluate decisions at work and in the community using information about the potential environmental, social, and economic impacts.	• Advanced

CRP.08. Utilize critical thinking to make sense of problems and persevere in solving them.	Measure
• CRP.08.01. Apply reason and logic to evaluate workplace and community situations from multiple perspectives.	• Advanced
• CRP.08.02. Investigate, prioritize and select solutions to solve problems in the workplace and community.	• Intermediate

Animal Systems Career Pathway Content Standards	
AS.01. Analyze historic and current trends impacting the animal systems industry.	**Measure**
• AS.01.02. Assess and select animal production, marketing, and management methods based upon effectiveness and potential social and environmental impacts.	• Intermediate
AS.06. Classify, evaluate and select animals based on anatomical and physiological characteristics.	**Measure**
• AS.06.02. Apply principles of comparative anatomy and physiology to uses within various animal systems.	• Advanced
• AS.06.03. Select animals for specific purposes and maximum performance based on anatomy and physiology.	• Advanced

Next Generation Science Standards (NGSS) Dimensions Integration

Crosscutting Concepts	
Patterns	Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them.
Systems and System Models	A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.
	• Systems can be designed to do specific tasks. • When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models. • Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales. • Models can be used to predict the behavior of a system, but these predictions have limited precision and reliability due to the assumptions and approximations inherent in models.

Understandings about the Nature of Science	
Science is a Way of Knowing	• Science is both a body of knowledge that represents a current understanding of natural systems and the processes used to refine, elaborate, revise, and extend this knowledge. • Science is a unique way of knowing and there are other ways of knowing. • Science distinguishes itself from other ways of knowing through use of empirical standards, logical arguments, and skeptical review. • Science knowledge has a history that includes the refinement of, and changes to, theories, ideas, and beliefs over time.

Common Core State Standards for English Language Arts

CCSS: English Language Arts Standards » Science & Technical Subjects » Grade 11-12	
Key Ideas and Details	• **RST.11-12.3 –** Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
Craft and Structure	• **RST.11-12.4 –** Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.

CCSS: English Language Arts Standards » Writing » Grade 11-12	
Text Types and Purposes	**WHST.11-12.1 –** Write arguments focused on discipline-specific content. • **WHST.11-12.1.D –** Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing. • **WHST.11-12.1.E –** Provide a concluding statement or section that follows from or supports the argument presented. **WHST.11-12.2 –** Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.

- **WHST.11-12.2.B –** Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.
- **WHST.11-12.2.C –** Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.
- **WHST.11-12.2.D –** Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.

Essential Questions

1. How do the *Five Freedoms of Animal Welfare* serve as a benchmark for evaluating and improving the well-being of animals in various settings?
2. What responsibilities do individuals and institutions have in ensuring that the *Five Freedoms of Animal Welfare* are upheld and respected in practice?
3. How do the tasks within animal care vary based on education level?
4. What are the limitations of animal care for an animal owner?
5. What makes animal systems codependent?
6. What are the key indicators or symptoms that may suggest illness or injury within an animal system?
7. How do different animal systems interact and depend on each other for overall health?
8. How does using standardized language contribute to clear communication among professionals in animal healthcare?
9. Why does the animal health community use consistent terminology?
10. In what ways does an interdisciplinary approach benefit the understanding and treatment of animals?
11. What are the various forms of professional verbal communication used in animal care settings?
12. What are the various forms of professional nonverbal communication used in animal care settings?
13. How are both verbal and nonverbal communication essential in animal healthcare?
14. How does empathy contribute to effective animal health care?
15. How can expressing empathy positively impact the well-being of animals?
16. How can an animal health careers benefit a community?

Lesson 2.2 Basic Prevention

Concepts	Performance Objectives
Students will know and understand	*Students will learn concepts by doing*
1. Animal caretakers conduct physical exams to assess animal health.	• Determine the body condition of animals using the body condition score scale. (Activity 2.2.1) • Practice taking dog vitals using industry practices. (Activity 2.2.2)
2. Safe handling and restraint procedures protect the animal and handler.	• Perform five different animal restraints. (Activity 2.2.3)
3. Preventative health care is vital for animal longevity.	• Demonstrate proper nail trimming procedures. (Activity 2.2.4)

	• Annotate an article about preventative dental care. (Activity 2.2.5) • Select preventative medication for a species. (Project 2.2.6)

National AFNR Content Standards Alignment

Career Ready Practices Content Standards	
CRP.04. Communicate clearly, effectively and with reason.	**Measure**
• CRP.04.01. Communicate using strategies that ensure clarity, logic, purpose and professionalism in formal and informal settings.	• Intermediate
• CRP.04.02. Produce clear, reasoned, and coherent written and visual communication in formal and informal settings.	• Intermediate
CRP.07. Employ valid and reliable research strategies.	**Measure**
• RP.07.01. Select and implement reliable research processes and methods to generate data for decision-making in the workplace and community.	• Intermediate
• CRP.07.02. Evaluate the validity of sources and data used when considering the adoption of new technologies, practices, and ideas in the workplace and community.	• Intermediate

Animal Systems Career Pathway Content Standards	
AS.01. Analyze historic and current trends impacting the animal systems industry.	**Measure**
• AS.01.02. Assess and select animal production, marketing, and management methods based upon effectiveness and potential social and environmental impacts.	• Intermediate
AS.02. Utilize best-practice protocols based upon animal behaviors for animal husbandry and welfare.	**Measure**
• AS.02.01. Explain management techniques that ensure animal welfare.	• Advanced
AS.04. Apply principles of animal reproduction to achieve desired outcomes for performance, development and/or economic production.	**Measure**
• AS.04.01. Evaluate animals for breeding readiness and soundness.	• Intermediate
AS.07. Apply principles of effective animal health care.	**Measure**
• AS.07.01. Design programs to prevent animal diseases, parasites, and other disorders and ensure animal welfare.	• Advanced
• AS.07.02. Analyze biosecurity measures utilized to protect the welfare of animals and health of humans on a local, state, national, and global level.	• Intermediate

Biotechnology Systems Career Pathway Content Standards	
BS.02: Demonstrate proficiency by safely applying appropriate laboratory skills to complete tasks in a biotechnology research and development environment (e.g., standard operating procedures, record keeping, aseptic technique, equipment maintenance, etc.).	**Measure**
• BS.02.01: Read, document, evaluate and secure accurate laboratory records of experimental protocols, observations and results.	• Beginning • Intermediate • Advanced
• BS.02.02: Implement standard operating procedures for the proper maintenance, use and sterilization of equipment in a laboratory.	• Advanced
• BS.02.03: Apply standard operating procedures for the safe handling of biological and chemical materials in a laboratory.	• Beginning • Intermediate • Advanced
• BS.02.04: Safely manage and dispose of biological materials, chemicals and wastes according to standard operating procedures.	• Beginning • Intermediate • Advanced
BS.03: Demonstrate the application of biotechnology to solve problems in AFNR systems (e.g., bioengineering, food processing, waste management, horticulture, forestry, livestock, crops, etc.).	**Measure**

• BS.03.04: Apply biotechnology principles, techniques and processes to enhance plant and animal care and production (e.g., selective breeding, pharmaceuticals, biodiversity, etc.).	• Beginning • Intermediate • Advanced

Next Generation Science Standards (NGSS) Dimensions Integration

Disciplinary Core Ideas	
Engineering, Technology, and the Application of Science	
Science and Engineering Practices	
Constructing Explanations and Designing Solutions	Constructing explanations and designing solutions in 9–12 builds on K– 8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. • Make a quantitative and/or qualitative claim regarding the relationship between dependent and independent variables. • Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. • Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects. • Apply scientific reasoning, theory, and/or models to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion. • Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.
Obtaining, Evaluating, and Communicating Information	Obtaining, evaluating, and communicating information in 9–12 builds on K–8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs. • Communicate scientific and/or technical information or ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically).

Understandings about the Nature of Science	
Science is a Way of Knowing	• Science is both a body of knowledge that represents a current understanding of natural systems and the processes used to refine, elaborate, revise, and extend this knowledge. • Science is a unique way of knowing and there are other ways of knowing. • Science distinguishes itself from other ways of knowing through use of empirical standards, logical arguments, and skeptical review. • Science knowledge has a history that includes the refinement of, and changes to, theories, ideas, and beliefs over time.
Scientific Knowledge Assumes an Order and Consistency in Natural Systems	• Scientific knowledge is based on the assumption that natural laws operate today as they did in the past and they will continue to do so in the future. • Science assumes the universe is a vast single system in which basic laws are consistent.

Common Core State Standards for English Language Arts

CCSS: English Language Arts Standards » Science & Technical Subjects » Grade 11-12	
Key Ideas and Details	• **RST.11-12.2 –** Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. • **RST.11-12.3 –** Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
Craft and Structure	• **RST.11-12.4 –** Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.
Integration of Knowledge and Ideas	• **RST.11-12.7 –** Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

	• **RST.11-12.8 –** Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. • **RST.11-12.9 –** Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
Range of Reading and Level of Text Complexity	• **RST.11-12.10 –** By the end of grade 12, read and comprehend science/technical texts in the grades 11-CCR text complexity band independently and proficiently.

Essential Questions

1. How does conducting a physical exam contribute to assessing overall animal health?
2. What indicators are considered during a physical examination to determine an animal's well-being?
3. Why is regular physical examination crucial for the early detection of health issues in animals?
4. What are the key principles behind safe handling and restraint procedures in veterinary practice?
5. How do appropriate handling techniques contribute to the well-being of both the animal and the handler?
6. What is the role of preventative care in animal health?
7. How does preventative health care contribute to the longevity of animals?
8. What specific procedures are considered essential for preventing common health issues in animals?
9. How might the findings from a physical exam influence a treatment decision?
10. What is the significance of preventative dental care in maintaining an animal's overall health?
11. How do preventative medicine contribute to animal health?

Lesson 3.1 Genetics and Parasites

Concepts	Performance Objectives
Students will know and understand	*Students will learn concepts by doing*
1. Accurate medical records help to create a safe and healthy environment for patients.	• Design and implement a lifestyle analysis questionnaire. (Activity 3.1.1)
2. Certain breeds or species are prone to specific health disorders.	• Select dog breeding pairings to avoid genetic disorders. (Activity 3.1.2) • Compile research on genetic disorders for a selected breed. (Project 3.1.3)
3. Animal health professionals identify parasites by their physical characteristics.	• Use researched information to identify parasite samples. (Activity 3.1.4) • Design a preventative maintenance plan for a goat herd. (Problem 3.1.6)
4. Conducting physical exams assesses animal health.	• Evaluate goats for internal parasites using the FAMACHA® system. (Activity 3.1.5) • Design a preventative maintenance plan for a goat herd. (Problem 3.1.6)
5. Preventative health care is vital for animal longevity.	• Design a preventative maintenance plan for a goat herd. (Problem 3.1.6)

National AFNR Content Standards Alignment

Career Ready Practices Content Standards	
CRP.04. Communicate clearly, effectively and with reason.	**Measure**
• CRP.04.01. Communicate using strategies that ensure clarity, logic, purpose and professionalism in formal and informal settings.	• Advanced
• CRP.04.02. Produce clear, reasoned, and coherent written and visual communication in formal and informal settings.	• Advanced
• CRP.04.03. Model active listening strategies when interacting with others in formal and informal settings.	• Advanced
CRP.09. Model integrity, ethical leadership, and effective management.	**Measure**
• CRP.09.02. Implement personal management skills to function effectively and efficiently in the workplace (e.g., time management, planning, prioritizing, etc.).	• Intermediate
• CRP.09.03. Demonstrate behaviors that contribute to a positive morale and culture in the workplace and community (e.g., positively influencing others, effectively communicating, etc.).	• Intermediate

Animal Systems Career Pathway Content Standards	
AS.02. Utilize best-practice protocols based upon animal behaviors for animal husbandry and welfare.	**Measure**
• AS.02.01. Explain management techniques that ensure animal welfare.	• Advanced
AS.04. Apply principles of animal reproduction to achieve desired outcomes for performance, development and/or economic production.	**Measure**
• AS.04.02. Apply scientific principles to select and care for breeding animals.	• Advanced
AS.07. Apply principles of effective animal health care.	**Measure**
• AS.07.01. Design programs to prevent animal diseases, parasites, and other disorders and ensure animal welfare.	• Advanced

Next Generation Science Standards (NGSS) Dimensions Integration

Disciplinary Core Ideas	
Life Science	
LS3: Heredity: Inheritance and Variation of Traits	
LS3.A: Inheritance of Traits	• Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA. The instructions for forming species' characteristics are carried in DNA. All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. Not all DNA codes for a protein; some segments of DNA are involved in regulatory or structural functions, and some have no as-yet known function.
Science and Engineering Practices	
Asking Questions and Defining Problems	Asking questions and defining problems in 9–12 builds on K–8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations. • Ask questions that arise from careful observation of phenomena, or unexpected results · to clarify and/or seek additional information. · that arise from examining models or a theory, to clarify and/or seek additional information and relationships. · to determine relationships, including quantitative relationships, between independent and dependent variables. · to clarify and refine a model, an explanation, or an engineering problem. • Evaluate a question to determine if it is testable and relevant. • Ask questions that can be investigated within the scope of the school laboratory, research facilities, or field (e.g., outdoor environment) with available resources and, when appropriate, frame a hypothesis based on a model or theory. • Ask and/or evaluate questions that challenge the premise(s) of an argument, the interpretation of a data set, or the suitability of a design. • Define a design problem that involves the development of a process or system with interacting components and criteria and constraints that may include social, technical and/or environmental considerations.
	Planning and carrying out investigations in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.

Planning and Carrying Out Investigations	• Plan an investigation or test a design individually and collaboratively to produce data to serve as the basis for evidence as part of building and revising models, supporting explanations for phenomena, or testing solutions to problems. Consider possible confounding variables or effects and evaluate the investigation's design to ensure variables are controlled. • Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. • Plan and conduct an investigation or test a design solution in a safe and ethical manner including considerations of environmental, social, and personal impacts. • Select appropriate tools to collect, record, analyze, and evaluate data. • Make directional hypotheses that specify what happens to a dependent variable when an independent variable is manipulated. • Manipulate variables and collect data about a complex model of a proposed process or system to identify failure points or improve performance relative to criteria for success or other variables.
Using Mathematics and Computational Thinking	Mathematical and computational thinking in 9-12 builds on K-8 and experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions. • Create and/or revise a computational model or simulation of a phenomenon, designed device, process, or system. • Use mathematical, computational, and/or algorithmic representations of phenomena or design solutions to describe and/or support claims and/or explanations. • Apply techniques of algebra and functions to represent and solve scientific and engineering problems. • Use simple limit cases to test mathematical expressions, computer programs, algorithms, or simulations of a process or system to see if a model "makes sense" by comparing the outcomes with what is known about the real world. • Apply ratios, rates, percentages, and unit conversions in the context of complicated measurement problems involving quantities with derived or compound units (such as mg/mL, kg/m3, acre-feet, etc.).
Constructing Explanations and Designing Solutions	Constructing explanations and designing solutions in 9–12 builds on K– 8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. • Make a quantitative and/or qualitative claim regarding the relationship between dependent and independent variables. • Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. • Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects. • Apply scientific reasoning, theory, and/or models to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion. • Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.
	• Make and defend a claim based on evidence about the natural world or the effectiveness of a design solution that reflects scientific knowledge, and student-generated evidence. • Evaluate competing design solutions to a real-world problem based on scientific ideas and principles, empirical evidence, and/or logical arguments regarding relevant factors (e.g. economic, societal, environmental, ethical considerations).
	• Communicate scientific and/or technical information or ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically).

Crosscutting Concepts	
Understandings about the Nature of Science	
Science is a Way of Knowing	• Science is both a body of knowledge that represents a current understanding of natural systems and the processes used to refine, elaborate, revise, and extend this knowledge. • Science is a unique way of knowing and there are other ways of knowing. • Science distinguishes itself from other ways of knowing through use of empirical standards, logical arguments, and skeptical review.

	• Science knowledge has a history that includes the refinement of, and changes to, theories, ideas, and beliefs over time.
Scientific Knowledge Assumes an Order and Consistency in Natural Systems	• Scientific knowledge is based on the assumption that natural laws operate today as they did in the past and they will continue to do so in the future. • Science assumes the universe is a vast single system in which basic laws are consistent.

Common Core State Standards for English Language Arts

CCSS: English Language Arts Standards » Science & Technical Subjects » Grade 11-12	
Key Ideas and Details	• **RST.11-12.3 –** Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
Craft and Structure	• **RST.11-12.4 –** Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.
Integration of Knowledge and Ideas	• **RST.11-12.7 –** Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. • **RST.11-12.9 –** Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
Range of Reading and Level of Text Complexity	• **RST.11-12.10 –** By the end of grade 12, read and comprehend science/technical texts in the grades 11-CCR text complexity band independently and proficiently.

CCSS: English Language Arts Standards » Writing » Grade 11-12	
Text Types and Purposes	**WHST.11-12.1 –** Write arguments focused on discipline-specific content. • **WHST.11-12.1.A –** Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence. • **WHST.11-12.1.B –** Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.
Research to Build and Present Knowledge	• **WHST.11-12.7 –** Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. • **WHST.11-12.8 –** Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. • **WHST.11-12.9 –** Draw evidence from informational texts to support analysis, reflection, and research.

Essential Questions

1. How can lifestyle analysis be used in animal program decision-making?
2. How do we interpret and apply lifestyle analysis questionnaire results to address individual needs?
3. What are common genetic disorders?
4. How can breeders prevent genetic disorders?
5. How can parasite samples be visually identified and categorized?
6. What tools and techniques are essential for identifying parasite samples?
7. What quality control measures ensure accuracy in identifying parasite samples?
8. What training or expertise is needed to use the FAMACHA® system for goat evaluations?

9. How can FAMACHA® system results inform goat health management and internal parasite control?
10. What factors contribute to a comprehensive preventative plan?

Lesson 3.2 Health Records

Concepts	Performance Objectives
Students will know and understand	*Students will learn concepts by doing*
1. Radio-frequency identification (RFID) is used by professionals and animal owners to identify animals.	• Construct a low-frequency RFID scanner to simulate LF ear tag and microchipping technology. (Activity 3.2.1)
2. Accurate medical records help to create a safe and healthy environment for patients.	• Perform a physical examination and compile a patient history. (Activity 3.2.2)
3. Animal health professionals protect client privacy.	• Summarize your state's veterinary medical records confidentiality rules. (Activity 3.2.2)
4. Body fluid samples require correct collection to prevent cross-contamination and get an accurate diagnosis.	• Practice collecting urine and fecal samples. (Activity 3.2.3)
5. Safe handling of patient specimen prevents accidents and zoonotic diseases.	• Follow the packaging and shipping protocol to submit fluid samples for testing. (Activity 3.2.3)
6. Diagnostic testing involves a comprehensive and systematic approach.	• Use a case study to create a systematic diagnostic approach. (Problem 3.2.4)

National AFNR Content Standards Alignment

Career Ready Practices Content Standards	
CRP.04. Communicate clearly, effectively and with reason.	**Measure**
• CRP.04.01. Communicate using strategies that ensure clarity, logic, purpose and professionalism in formal and informal settings.	• Intermediate
• CRP.04.02. Produce clear, reasoned, and coherent written and visual communication in formal and informal settings.	• Intermediate
CRP.05. Consider the environmental, social and economic impacts of decisions.	**Measure**
• CRP.05.02. Make, defend, and evaluate decisions at work and in the community using information about the potential environmental, social, and economic impacts.	• Intermediate
CRP.08. Utilize critical thinking to make sense of problems and persevere in solving them.	**Measure**
• CRP.08.01. Apply reason and logic to evaluate workplace and community situations from multiple perspectives.	• Intermediate

Animal Systems Career Pathway Content Standards	
AS.01. Analyze historic and current trends impacting the animal systems industry.	**Measure**
• AS.01.03. Analyze laws and sustainable practices that impact animal agriculture from a local, tribal, state, national, and global perspective.	• Intermediate
AS.02. Utilize best-practice protocols based upon animal behaviors for animal husbandry and welfare.	**Measure**
• AS.02.01. Explain management techniques that ensure animal welfare.	• Intermediate

Biotechnology Systems Career Pathway Content Standards	
BS.02: Demonstrate proficiency by safely applying appropriate laboratory skills to complete tasks in a biotechnology research and development environment (e.g., standard operating procedures, record keeping, aseptic technique, equipment maintenance, etc.).	**Measure**
• BS.02.01: Read, document, evaluate and secure accurate laboratory records of experimental protocols, observations and results.	• Advanced
• BS.02.02: Implement standard operating procedures for the proper maintenance, use and sterilization of equipment in a laboratory.	• Advanced
• BS.02.03: Apply standard operating procedures for the safe handling of biological and chemical materials in a laboratory.	• Advanced
• BS.02.04: Safely manage and dispose of biological materials, chemicals and wastes according to standard operating procedures.	• Advanced
BS.03: Demonstrate the application of biotechnology to solve problems in AFNR systems (e.g., bioengineering, food processing, waste management, horticulture, forestry, livestock, crops, etc.).	**Measure**
• BS.03.04: Apply biotechnology principles, techniques and processes to enhance plant and animal care and production (e.g., selective breeding, pharmaceuticals, biodiversity, etc.).	• Advanced

Next Generation Science Standards (NGSS) Dimensions Integration

Disciplinary Core Ideas	
Science and Engineering Practices	
Asking Questions and Defining Problems	Asking questions and defining problems in 9–12 builds on K–8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations. • Ask questions that arise from careful observation of phenomena, or unexpected results · to clarify and/or seek additional information. · that arise from examining models or a theory, to clarify and/or seek additional information and relationships. · to determine relationships, including quantitative relationships, between independent and dependent variables. · to clarify and refine a model, an explanation, or an engineering problem. • Evaluate a question to determine if it is testable and relevant. • Ask questions that can be investigated within the scope of the school laboratory, research facilities, or field (e.g., outdoor environment) with available resources and, when appropriate, frame a hypothesis based on a model or theory. • Ask and/or evaluate questions that challenge the premise(s) of an argument, the interpretation of a data set, or the suitability of a design. • Define a design problem that involves the development of a process or system with interacting components and criteria and constraints that may include social, technical and/or environmental considerations.
Planning and Carrying Out Investigations	Planning and carrying out investigations in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models. • Plan an investigation or test a design individually and collaboratively to produce data to serve as the basis for evidence as part of building and revising models, supporting explanations for phenomena, or testing solutions to problems. Consider possible confounding variables or effects and evaluate the investigation's design to ensure variables are controlled. • Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. • Plan and conduct an investigation or test a design solution in a safe and ethical manner including considerations of environmental, social, and personal impacts. • Select appropriate tools to collect, record, analyze, and evaluate data. • Make directional hypotheses that specify what happens to a dependent variable when an independent variable is manipulated. • Manipulate variables and collect data about a complex model of a proposed process or system to identify failure points or improve performance relative to criteria for success or other variables.
Using Mathematics and Computational Thinking	Mathematical and computational thinking in 9-12 builds on K-8 and experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.

	• Create and/or revise a computational model or simulation of a phenomenon, designed device, process, or system. • Use mathematical, computational, and/or algorithmic representations of phenomena or design solutions to describe and/or support claims and/or explanations. • Apply techniques of algebra and functions to represent and solve scientific and engineering problems. • Use simple limit cases to test mathematical expressions, computer programs, algorithms, or simulations of a process or system to see if a model "makes sense" by comparing the outcomes with what is known about the real world. • Apply ratios, rates, percentages, and unit conversions in the context of complicated measurement problems involving quantities with derived or compound units (such as mg/mL, kg/m3, acre-feet, etc.).
Constructing Explanations and Designing Solutions	Constructing explanations and designing solutions in 9–12 builds on K– 8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. • Make a quantitative and/or qualitative claim regarding the relationship between dependent and independent variables. • Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. • Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects. • Apply scientific reasoning, theory, and/or models to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion. • Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

Understandings about the Nature of Science	
Science is a Way of Knowing	• Science is both a body of knowledge that represents a current understanding of natural systems and the processes used to refine, elaborate, revise, and extend this knowledge. • Science is a unique way of knowing and there are other ways of knowing. • Science distinguishes itself from other ways of knowing through use of empirical standards, logical arguments, and skeptical review. • Science knowledge has a history that includes the refinement of, and changes to, theories, ideas, and beliefs over time.

Common Core State Standards for English Language Arts

CCSS: English Language Arts Standards » Science & Technical Subjects » Grade 11-12	
Key Ideas and Details	• **RST.11-12.3 –** Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
Craft and Structure	• **RST.11-12.4 –** Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.
Integration of Knowledge and Ideas	• **RST.11-12.7 –** Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. • **RST.11-12.9 –** Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

CCSS: English Language Arts Standards » Writing » Grade 11-12	
Text Types and Purposes	**WHST.11-12.1 –** Write arguments focused on discipline-specific content. • **WHST.11-12.1.A –** Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence. • **WHST.11-12.1.B –** Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.

Production and Distribution of Writing	• **WHST.11-12.4 –** Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. • **WHST.11-12.5 –** Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. • **WHST.11-12.6 –** Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.

Essential Questions

1. How are animals identified?
2. What benefits does RFID technology offer in animal health?
3. What information is crucial to include when compiling a comprehensive patient history?
4. Why do animal health professionals gather a patient's medical background during a physical examination?
5. What role does a thorough patient history play in the diagnostic process?
6. How can compiling a patient's history contribute to personalized and effective veterinary treatment plans?
7. How do state regulations influence the ethical handling of veterinary medical information?
8. How does adherence to confidentiality rules impact the veterinarian-client relationship?
9. What are the proper techniques for collecting animal urine samples in a veterinary setting?
10. How does the collection of fecal samples contribute to diagnostic processes in veterinary medicine?
11. What precautions ensure the accuracy and integrity of collected body fluid samples?
12. What protocol is involved in packaging and shipping fluid samples for diagnostic testing?
13. How do packaging and shipping protocols contribute to the reliability of diagnostic results?
14. What makes diagnostic testing in veterinary medicine thorough and systematic?
15. How do various diagnostic methods improve accuracy in identifying animal health problems?

Lesson 4.1 Prescribed Medicine

Concepts	Performance Objectives
Students will know and understand	*Students will learn concepts by doing*
1. The Drug Enforcement Agency rates prescription drugs by schedules based on their potential for dependence.	• Classify animal pharmaceuticals in different ways. (Activity 4.1.1)
2. Medicine labels contain information about drug use and precautions.	• Locate relevant information on medication labels. (Activity 4.1.2)
3. Animal health professionals calculate and label medications to ensure accurate dosing.	• Interpret prescriptions and calculate the dosage for different scenarios. (Activity 4.1.3) • Practice filling multiple prescriptions and communicating instructions to clients. (Activity 4.1.4)
4. Animal health professionals administer medications for animal health.	• Administer ophthalmic, oral, and aural medication. (Activity 4.1.5)

5. Animal health professions follow storage and handling to maximize drug efficacy.	• Recommend medication storage and recordkeeping to a veterinary clinic. (Problem 4.1.6)

National AFNR Content Standards Alignment

Career Ready Practices Content Standards	
CRP.02. Apply appropriate academic and technical skills.	**Measure**
• CRP.02.01. Use strategic thinking to connect and apply academic learning, technical knowledge, and skills to solve problems in the workplace and community.	• Advanced
CRP.04. Communicate clearly, effectively and with reason.	**Measure**
• CRP.04.01. Communicate using strategies that ensure clarity, logic, purpose and professionalism in formal and informal settings.	• Intermediate
• CRP.04.02. Produce clear, reasoned, and coherent written and visual communication in formal and informal settings.	• Intermediate
CRP.05. Consider the environmental, social and economic impacts of decisions.	**Measure**
• CRP.05.01. Assess, identify, and synthesize the information and resources needed to make decisions that positively impact the workplace and community.	• Advanced
• CRP.05.02. Make, defend, and evaluate decisions at work and in the community using information about the potential environmental, social, and economic impacts.	• Advanced
CRP.06.01. Synthesize information, knowledge, and experience to generate original ideas and challenge assumptions in the workplace and community.	**Measure**
• CRP.06.02. Assess a variety of workplace and community situations to identify ways to add value and improve the efficiency of processes and procedures.	• Advanced
• CRP.06.03. Create and execute a plan of action for new ideas and introduce innovations to workplace and community organizations.	• Intermediate

Animal Systems Career Pathway Content Standards	
AS.01. Analyze historic and current trends impacting the animal systems industry.	**Measure**
• AS.01.03. Analyze laws and sustainable practices that impact animal agriculture from a local, tribal, state, national, and global perspective.	• Advanced
AS.02. Utilize best-practice protocols based upon animal behaviors for animal husbandry and welfare.	**Measure**
• AS.02.01. Explain management techniques that ensure animal welfare.	• Advanced
• AS.02.02. Analyze procedures to ensure that animal products are safe for consumption.	• Intermediate
AS.07. Apply principles of effective animal health care.	**Measure**
• AS.07.01. Design programs to prevent animal diseases, parasites, and other disorders and ensure animal welfare.	• Intermediate
• AS.07.02. Analyze biosecurity measures utilized to protect the welfare of animals and health of humans on a local, state, national, and global level.	• Intermediate

Biotechnology Systems Career Pathway Content Standards	
BS.02: Demonstrate proficiency by safely applying appropriate laboratory skills to complete tasks in a biotechnology research and development environment (e.g., standard operating procedures, record keeping, aseptic technique, equipment maintenance, etc.).	**Measure**
• BS.02.01: Read, document, evaluate and secure accurate laboratory records of experimental protocols, observations and results.	• Intermediate
BS.03: Demonstrate the application of biotechnology to solve problems in AFNR systems (e.g., bioengineering, food processing, waste management, horticulture, forestry, livestock, crops, etc.).	**Measure**
• BS.03.04: Apply biotechnology principles, techniques and processes to enhance plant and animal care and production (e.g., selective breeding, pharmaceuticals, biodiversity, etc.).	• Advanced

Next Generation Science Standards (NGSS) Dimensions Integration

Disciplinary Core Ideas	
Science and Engineering Practices	
Asking Questions and Defining Problems	Asking questions and defining problems in 9–12 builds on K–8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations. • Ask questions that arise from careful observation of phenomena, or unexpected results · to clarify and/or seek additional information. · that arise from examining models or a theory, to clarify and/or seek additional information and relationships. · to determine relationships, including quantitative relationships, between independent and dependent variables. · to clarify and refine a model, an explanation, or an engineering problem. • Evaluate a question to determine if it is testable and relevant. • Ask questions that can be investigated within the scope of the school laboratory, research facilities, or field (e.g., outdoor environment) with available resources and, when appropriate, frame a hypothesis based on a model or theory. • Ask and/or evaluate questions that challenge the premise(s) of an argument, the interpretation of a data set, or the suitability of a design. • Define a design problem that involves the development of a process or system with interacting components and criteria and constraints that may include social, technical and/or environmental considerations.
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Using Mathematics and Computational Thinking	Mathematical and computational thinking in 9-12 builds on K-8 and experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions. • Create and/or revise a computational model or simulation of a phenomenon, designed device, process, or system. • Use mathematical, computational, and/or algorithmic representations of phenomena or design solutions to describe and/or support claims and/or explanations. • Apply techniques of algebra and functions to represent and solve scientific and engineering problems. • Use simple limit cases to test mathematical expressions, computer programs, algorithms, or simulations of a process or system to see if a model "makes sense" by comparing the outcomes with what is known about the real world. • Apply ratios, rates, percentages, and unit conversions in the context of complicated measurement problems involving quantities with derived or compound units (such as mg/mL, kg/m3, acre-feet, etc.).
Constructing Explanations and Designing Solutions	Constructing explanations and designing solutions in 9–12 builds on K– 8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. • Make a quantitative and/or qualitative claim regarding the relationship between dependent and independent variables. • Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. • Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.

	• Apply scientific reasoning, theory, and/or models to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion. • Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

Crosscutting Concepts	
Scale, Proportion, and Quantity	In considering phenomena, it is critical to recognize what is relevant at different size, time, and energy scales, and to recognize proportional relationships between different quantities as scales change.
	• The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs. • Some systems can only be studied indirectly as they are too small, too large, too fast, or too slow to observe directly. • Patterns observable at one scale may not be observable or exist at other scales. • Using the concept of orders of magnitude allows one to understand how a model at one scale relates to a model at another scale. • Algebraic thinking is used to examine scientific data and predict the effect of a change in one variable on another (e.g., linear growth vs. exponential growth).

Understandings about the Nature of Science	
Science is a Way of Knowing	• Science is both a body of knowledge that represents a current understanding of natural systems and the processes used to refine, elaborate, revise, and extend this knowledge. • Science is a unique way of knowing and there are other ways of knowing. • Science distinguishes itself from other ways of knowing through use of empirical standards, logical arguments, and skeptical review. • Science knowledge has a history that includes the refinement of, and changes to, theories, ideas, and beliefs over time.

Common Core State Standards for High School Mathematics

Modeling standards are indicated by the star symbol (*) throughout other conceptual categories.

CCSS: Conceptual Category – Algebra	
Seeing Structure in Expressions	*Interpret the structure of expressions. *Write expressions in equivalent forms to solve problems.
Reasoning with Equations and Inequalities	Understand solving equations as a process of reasoning and explain the reasoning. Solve equations and inequalities in one variable. Solve systems of equations. *Represent and solve equations and inequalities graphically.

Common Core State Standards for English Language Arts

CCSS: English Language Arts Standards » Science & Technical Subjects » Grade 11-12	
Key Ideas and Details	• **RST.11-12.3 –** Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
Craft and Structure	• **RST.11-12.4 –** Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.
Integration of Knowledge and Ideas	• **RST.11-12.7 –** Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. • **RST.11-12.9 –** Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
Range of Reading and Level of Text Complexity	• **RST.11-12.10 –** By the end of grade 12, read and comprehend science/technical texts in the grades 11-CCR text complexity band independently and proficiently.

Essential Questions

1. What criteria determine the scheduling of prescription drugs for animals?
2. How does the potential for dependence influence drug storage and recordkeeping?

3. What essential information is found on medication labels for animals?
4. How do medicine labels address the specific needs of animals?
5. How do medicine labels address the concerns of animal drug use?
6. What factors do animal health professionals consider when calculating medication dosages for animals?
7. How do standardized guidelines for calculating and labeling medications impact animal health?
8. Why do animal health professionals use different methods to administer medications to animals?
9. How are appropriate dosage and administration routes determined for different species?
10. Why is proper storage essential for maintaining medication efficacy?
11. What are the consequences of medication degradation?

Lesson 4.2 Needles and Bandages

Concepts	Performance Objectives
Students will know and understand	*Students will learn concepts by doing*
1. Animal caretakers use proper injection techniques.	• Practice the correct procedure for selecting a needle and filling a syringe. (Activity 4.2.1) • Simulate animal medication injections. (Activity 4.2.2)
2. Animal health professionals calculate and label medications to ensure accurate dosing.	• Calculate accurate doses using the information in a scenario. (Activity 4.2.3)
3. Animal surgical nursing skills provide proper patient care.	• Perform wound care by cleaning, applying bandaging, and removing bandaging. (Activity 4.2.4) • Practice suturing and removing sutures. (Activity 4.2.5)
4. Vaccinations protect animals from deadly diseases and improve their overall health.	• Develop a vaccination schedule for the lifetime of an animal. (Problem 4.2.6)

National AFNR Content Standards Alignment

Career Ready Practices Content Standards	
CRP.04. Communicate clearly, effectively and with reason.	**Measure**
• CRP.04.01. Communicate using strategies that ensure clarity, logic, purpose and professionalism in formal and informal settings.	• Advanced
• CRP.04.02. Produce clear, reasoned, and coherent written and visual communication in formal and informal settings.	• Advanced
CRP.07. Employ valid and reliable research strategies.	**Measure**
• RP.07.01. Select and implement reliable research processes and methods to generate data for decision-making in the workplace and community.	• Advanced
• CRP.07.02. Evaluate the validity of sources and data used when considering the adoption of new technologies, practices, and ideas in the workplace and community.	• Advanced

Animal Systems Career Pathway Content Standards	
AS.02. Utilize best-practice protocols based upon animal behaviors for animal husbandry and welfare.	**Measure**
• AS.02.01. Explain management techniques that ensure animal welfare.	• Advanced

• AS.02.02. Analyze procedures to ensure that animal products are safe for consumption.	• Intermediate
AS.06. Classify, evaluate and select animals based on anatomical and physiological characteristics.	**Measure**
• AS.06.02. Apply principles of comparative anatomy and physiology to uses within various animal systems.	• Intermediate
AS.07. Apply principles of effective animal health care.	**Measure**
• AS.07.01. Design programs to prevent animal diseases, parasites, and other disorders and ensure animal welfare.	• Advanced
• AS.07.02. Analyze biosecurity measures utilized to protect the welfare of animals and health of humans on a local, state, national, and global level.	• Intermediate

Biotechnology Systems Career Pathway Content Standards	
BS.02: Demonstrate proficiency by safely applying appropriate laboratory skills to complete tasks in a biotechnology research and development environment (e.g., standard operating procedures, record keeping, aseptic technique, equipment maintenance, etc.).	**Measure**
• BS.02.01: Read, document, evaluate and secure accurate laboratory records of experimental protocols, observations and results.	• Advanced
• BS.02.02: Implement standard operating procedures for the proper maintenance, use and sterilization of equipment in a laboratory.	• Advanced
• BS.02.04: Safely manage and dispose of biological materials, chemicals and wastes according to standard operating procedures.	• Intermediate
BS.03: Demonstrate the application of biotechnology to solve problems in AFNR systems (e.g., bioengineering, food processing, waste management, horticulture, forestry, livestock, crops, etc.).	**Measure**
• BS.03.04: Apply biotechnology principles, techniques and processes to enhance plant and animal care and production (e.g., selective breeding, pharmaceuticals, biodiversity, etc.).	• Advanced

Next Generation Science Standards (NGSS) Dimensions Integration

Disciplinary Core Ideas	
Science and Engineering Practices	
Asking Questions and Defining Problems	Asking questions and defining problems in 9–12 builds on K–8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations. • Ask questions that arise from careful observation of phenomena, or unexpected results · to clarify and/or seek additional information. · that arise from examining models or a theory, to clarify and/or seek additional information and relationships. · to determine relationships, including quantitative relationships, between independent and dependent variables. · to clarify and refine a model, an explanation, or an engineering problem. • Evaluate a question to determine if it is testable and relevant. • Ask questions that can be investigated within the scope of the school laboratory, research facilities, or field (e.g., outdoor environment) with available resources and, when appropriate, frame a hypothesis based on a model or theory. • Ask and/or evaluate questions that challenge the premise(s) of an argument, the interpretation of a data set, or the suitability of a design. • Define a design problem that involves the development of a process or system with interacting components and criteria and constraints that may include social, technical and/or environmental considerations.
Planning and Carrying Out Investigations	Planning and carrying out investigations in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models. • Plan an investigation or test a design individually and collaboratively to produce data to serve as the basis for evidence as part of building and revising models, supporting explanations for phenomena, or testing solutions to problems. Consider possible confounding variables or effects and evaluate the investigation's design to ensure variables are controlled. • Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. • Plan and conduct an investigation or test a design solution in a safe and ethical manner including considerations of environmental, social, and personal impacts. • Select appropriate tools to collect, record, analyze, and evaluate data.

	• Make directional hypotheses that specify what happens to a dependent variable when an independent variable is manipulated. • Manipulate variables and collect data about a complex model of a proposed process or system to identify failure points or improve performance relative to criteria for success or other variables.
Using Mathematics and Computational Thinking	Mathematical and computational thinking in 9-12 builds on K-8 and experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions. • Create and/or revise a computational model or simulation of a phenomenon, designed device, process, or system. • Use mathematical, computational, and/or algorithmic representations of phenomena or design solutions to describe and/or support claims and/or explanations. • Apply techniques of algebra and functions to represent and solve scientific and engineering problems. • Use simple limit cases to test mathematical expressions, computer programs, algorithms, or simulations of a process or system to see if a model "makes sense" by comparing the outcomes with what is known about the real world. • Apply ratios, rates, percentages, and unit conversions in the context of complicated measurement problems involving quantities with derived or compound units (such as mg/mL, kg/m3, acre-feet, etc.).
Constructing Explanations and Designing Solutions	Constructing explanations and designing solutions in 9–12 builds on K– 8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. • Make a quantitative and/or qualitative claim regarding the relationship between dependent and independent variables. • Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. • Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects. • Apply scientific reasoning, theory, and/or models to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion. • Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

Crosscutting Concepts	
Structure and Function	The way an object is shaped or structured determines many of its properties and functions.
	• Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem. • The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials.

Understandings about the Nature of Science	
Science is a Way of Knowing	• Science is both a body of knowledge that represents a current understanding of natural systems and the processes used to refine, elaborate, revise, and extend this knowledge. • Science is a unique way of knowing and there are other ways of knowing. • Science distinguishes itself from other ways of knowing through use of empirical standards, logical arguments, and skeptical review. • Science knowledge has a history that includes the refinement of, and changes to, theories, ideas, and beliefs over time.

Common Core State Standards for High School Mathematics

Modeling standards are indicated by the star symbol (*) throughout other conceptual categories.

CCSS: Conceptual Category – Algebra	
Seeing Structure in Expressions	*Interpret the structure of expressions. *Write expressions in equivalent forms to solve problems.
	Understand solving equations as a process of reasoning and explain the reasoning.

Reasoning with Equations and Inequalities	Solve equations and inequalities in one variable. Solve systems of equations. *Represent and solve equations and inequalities graphically.

Common Core State Standards for English Language Arts

CCSS: English Language Arts Standards » Science & Technical Subjects » Grade 11-12	
Key Ideas and Details	• **RST.11-12.3 –** Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
Craft and Structure	• **RST.11-12.4 –** Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.
Integration of Knowledge and Ideas	• **RST.11-12.7 –** Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. • **RST.11-12.9 –** Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
Range of Reading and Level of Text Complexity	• **RST.11-12.10 –** By the end of grade 12, read and comprehend science/technical texts in the grades 11-CCR text complexity band independently and proficiently.

Essential Questions

1. Why are different injection methods used in animal healthcare?
2. What is the purpose of vaccinations in animal health?
3. Why are regular vaccinations important for pets and livestock?
4. Why is accurate medication dosage crucial in veterinary care?
5. How do animal health professionals calculate medication dosages?
6. What risks are associated with undermedication or overmedication?
7. How does precise dosing contribute to optimal treatment outcomes?
8. How do surgical nursing skills contribute to animal care?
9. What measures can animal owners take to minimize complications to wound care?
10. How do vaccinations effectively shield animals from deadly diseases?
11. What are the key factors to consider when implementing vaccination protocols for animals?

Lesson 5.1 Skill Assessment

Concepts	Performance Objectives
Students will know and understand	*Students will learn concepts by doing*
1. Agricultural employees need to work efficiently and communicate effectively in the workplace.	• Observe a veterinarian perform a physical examination. (Activity 5.1.1)
2. Animal caretakers use an emergency plan and a first aid kit for emergency animal care.	• Develop an emergency kit for the animal of your choice. (Project 5.1.2)
3. Animal health professionals use technical and interpersonal skills to care for animals.	• Learn about veterinary clinic employee expectations. (Activity 5.1.1) • Demonstrate technical and interpersonal skills learned in this course. (Project 5.1.3)

National AFNR Content Standards Alignment

Career Ready Practices Content Standards	
CRP.01. Act as a responsible and contributing citizen and employee.	**Measure**
• CRP.01.01. Model personal responsibility in the workplace and community.	• Intermediate
• CRP.01.03. Identify and act upon opportunities for professional and community service at the workplace	• Intermediate
CRP.02. Apply appropriate academic and technical skills.	**Measure**
• CRP.02.01. Use strategic thinking to connect and apply academic learning, technical knowledge, and skills to solve problems in the workplace and community.	• Advanced
CRP.04. Communicate clearly, effectively and with reason.	**Measure**
• CRP.04.01. Communicate using strategies that ensure clarity, logic, purpose and professionalism in formal and informal settings.	• Advanced
CRP.08. Utilize critical thinking to make sense of problems and persevere in solving them.	**Measure**
• CRP.08.01. Apply reason and logic to evaluate workplace and community situations from multiple perspectives.	• Advanced

Animal Systems Career Pathway Content Standards	
AS.02. Utilize best-practice protocols based upon animal behaviors for animal husbandry and welfare.	**Measure**
• AS.02.01. Explain management techniques that ensure animal welfare.	• Advanced
AS.07. Apply principles of effective animal health care.	**Measure**
• AS.07.01. Design programs to prevent animal diseases, parasites, and other disorders and ensure animal welfare.	• Intermediate
• AS.07.02. Analyze biosecurity measures utilized to protect the welfare of animals and health of humans on a local, state, national, and global level.	• Advanced

Biotechnology Systems Career Pathway Content Standards	
BS.02: Demonstrate proficiency by safely applying appropriate laboratory skills to complete tasks in a biotechnology research and development environment (e.g., standard operating procedures, record keeping, aseptic technique, equipment maintenance, etc.).	**Measure**
• BS.02.02: Implement standard operating procedures for the proper maintenance, use and sterilization of equipment in a laboratory.	• Advanced
• BS.02.03: Apply standard operating procedures for the safe handling of biological and chemical materials in a laboratory.	• Advanced
• BS.02.04: Safely manage and dispose of biological materials, chemicals and wastes according to standard operating procedures.	• Advanced
BS.03: Demonstrate the application of biotechnology to solve problems in AFNR systems (e.g., bioengineering, food processing, waste management, horticulture, forestry, livestock, crops, etc.).	**Measure**
• BS.03.04: Apply biotechnology principles, techniques and processes to enhance plant and animal care and production (e.g., selective breeding, pharmaceuticals, biodiversity, etc.).	• Advanced

Common Core State Standards for English Language Arts

CCSS: English Language Arts Standards » Science & Technical Subjects » Grade 11-12	
Key Ideas and Details	• **RST.11-12.3 –** Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
Craft and Structure	• **RST.11-12.4 –** Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.

Essential Questions

1. What interpersonal skills do animal health care workers need?

2. How are communication skills important in animal health?
3. What are the qualities of a good employee?
4. What components are essential for an effective emergency plan for animal care?
5. How do different types of animals have specific requirements in an emergency?
6. How can animal needs be addressed in a first aid kit?
7. What role does education play in ensuring animal owners are well-prepared to handle emergencies?
8. Which technical skills are crucial for success in the animal healthcare industry?
9. How do interpersonal skills such as communication, teamwork, and problem-solving contribute to success in the agricultural industry?
10. How can interpersonal skills be honed through practical experience?
11. In what ways can technical and soft skills benefit future animal industry careers?