BIOTECHNOLOGY STANDARDS

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All Nevadans ready for success in the 21st century

MISSION

To improve student achievement and educator effectiveness by ensuring opportunities, facilitating learning, and promoting excellence

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BUSINESS AND INDUSTRY VALIDATION

All CTE standards developed through the Nevada Department of Education are validated by business and industry through one or more of the following processes: (1) the standards are developed by a team consisting of business and industry representatives; or (2) a separate review panel was coordinated with industry experts to ensure the standards include the proper content; or (3) the adoption of nationally-recognized standards endorsed by business and industry.

The Biotechnology standards were validated through active participation of business and industry representatives on the development team.

PROJECT COORDINATOR

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INTRODUCTION

The standards in this document are designed to clearly state what the student should know and be able to do upon completion of an advanced high school Biotechnology program. These standards are designed for a three-credit course sequence that prepares the student for a technical assessment directly aligned to the standards.

These exit-level standards are designed for the student to complete all standards through their completion of a program of study. These standards are intended to guide curriculum objectives for a program of study.

The standards are organized as follows:

Content Standards are general statements that identify major areas of knowledge, understanding, and the skills students are expected to learn in key subject and career areas by the end of the program.

Performance Standards follow each content standard. Performance standards identify the more specific components of each content standard and define the expected abilities of students within each content standard.

Performance Indicators are very specific criteria statements for determining whether a student meets the performance standard. Performance indicators may also be used as learning outcomes, which teachers can identify as they plan their program learning objectives.

The crosswalk and alignment section of the document shows where the performance indicators support the Nevada Academic Content Standards in Science (based on the Next Generation Science Standards) and in English Language Arts and Mathematics (based on the Common Core State Standards). Where correlation with an academic content standard exists, students in the Biotechnology program perform learning activities that support, either directly or indirectly, achievement of the academic content standards that are listed.

All students are encouraged to participate in the career and technical student organization (CTSO) that relates to the Biotechnology program. CTSOs are co-curricular national associations that directly enforce learning in the CTE classroom through curriculum resources, competitive events, and leadership development. CTSOs provide students the ability to apply academic and technical knowledge, develop communication and teamwork skills, and cultivate leadership skills to ensure college and career readiness.

The Employability Skills for Career Readiness identify the “soft skills” needed to be successful in all careers, and must be taught as an integrated component of all CTE course sequences. These standards are available in a separate document.

The **Standards Reference Code** is only used to identify or align performance indicators listed in the standards to daily lesson plans, curriculum documents, or national standards.

Biotechnology: Biotechnology Standards Reference Code: **BIOT**

Example: BIOT.2.3.4

Standards	Content Standard	Performance Standard	Performance Indicator
Biotechnology	2	3	4

CONTENT STANDARD 1.0 : RECOGNIZE THE HISTORICAL, SOCIAL, CULTURAL, AND	
PERFORMANCE STANDARD 1.1 :	**DISTINGUISH MAJOR INNOVATORS, HISTORICAL DEVELOPMENTS, AND POTENTIAL APPLICATIONS OF BIOTECHNOLOGY**
1.1.1	Define biotechnology and investigate current applications of biotechnology in agriculture
1.1.2	Research major innovators and historical milestones in the development of biotechnology
1.1.3	Discuss emerging technologies and issues associated with agricultural biotechnology
1.1.4	Analyze the scope and impact of agricultural biotechnology in today's society
1.1.5	Assess the future impact agricultural biotechnology could have on world populations
PERFORMANCE STANDARD 1.2 :	**DETERMINE REGULATORY ISSUES AND IDENTIFY AGENCIES ASSOCIATED WITH BIOTECHNOLOGY**
1.2.1	Describe the role of agencies that regulate biotechnology including USDA, FDA, and EPA
1.2.2	Interpret the major regulatory issues related to biotechnology
1.2.3	Research, evaluate, and articulate a major regulatory issue pertaining to biotechnology
PERFORMANCE STANDARD 1.3 :	**ANALYZE THE ETHICAL, LEGAL, SOCIAL, AND CULTURAL ISSUES RELATING TO BIOTECHNOLOGY**
1.3.1	Evaluate the benefits and risks associated with biotechnology
1.3.2	Research and debate an ethical issue associated with biotechnology
1.3.3	Articulate the implications of an ethical, legal, social, or cultural biotechnology issue

CONTENT STANDARD 2.0 : DEMONSTRATE LABORATORY SAFETY PRACTICES	
PERFORMANCE STANDARD 2.1 :	**SAFELY MANAGE BIOLOGICAL MATERIALS, CHEMICALS, AND WASTES USED IN THE LABORATORY**
2.1.1	Identify and describe hazards associated with biological and chemical materials
2.1.2	Read and interpret Safety Data Sheets (SDS)
2.1.3	Maintain a safe environment by properly identifying and disposing of laboratory waste
PERFORMANCE STANDARD 2.2 :	**DEMONSTRATE UNDERSTANDING OF REQUIRED SAFETY PRACTICES AND PROCEDURES**
2.2.1	Define health and safety regulations, including Occupational Safety and Health Administration (OSHA), Environmental Protection Agency (EPA), Nevada Division of Environmental Protection (NDEP), and Right to Know
2.2.2	Demonstrate procedures for documenting hazards and compliance
2.2.3	Identify and demonstrate proper use of personal protective equipment (PPE)
2.2.4	Demonstrate proper use of laboratory safety equipment (e.g., eye wash, fire blanket, fire extinguisher, spill kit)
2.2.5	Discuss universal precautions associated with biological and chemical hazards

CONTENT STANDARD 3.0 : DEMONSTRATE LABORATORY SKILLS AS APPLIED TO
PERFORMANCE STANDARD 3.1 : MAINTAIN AND INTERPRET BIOTECHNOLOGY LABORATORY RECORDS
3.1.1 Demonstrate accurate and ethical record keeping and data collection
3.1.2 Validate records and data by incorporation of peer review
3.1.3 Analyze data and draw conclusions
3.1.4 Propose future investigations based on data analysis and conclusions
PERFORMANCE STANDARD 3.2 : DEMONSTRATE PROPER LABORATORY PROCEDURES
3.2.1 Properly operate laboratory equipment and measurement devices
3.2.2 Perform procedures according to directions
3.2.3 Demonstrate aseptic techniques in the laboratory
3.2.4 Develop an appropriate standard operating procedure (SOP) *(e.g., SOP for making a sandwich)*
3.2.5 Demonstrate the preparation of solutions using appropriate quantities and standard protocols

CONTENT STANDARD 4.0 : PERFORM MICROBIOLOGY, MOLECULAR BIOLOGY,

PERFORMANCE STANDARD 4.1 : PERFORM MICROBIOLOGY PROCEDURES

- 4.1.1 Differentiate types of organisms and demonstrate how to handle them safely
- 4.1.2 Research and describe the use of biotechnology to identify microbes

PERFORMANCE STANDARD 4.2 : PERFORM MOLECULAR BIOLOGY PROCEDURES

- 4.2.1 Explain the structures of DNA and RNA and how genotype can influence phenotype
- 4.2.2 Explain the molecular basis for heredity
- 4.2.3 Summarize the use of tools and techniques in DNA and RNA manipulations
- 4.2.4 Analyze factors and probabilities that influence gene expression
- 4.2.5 Extract DNA
- 4.2.6 Perform or simulate the process of polymerase chain reaction (PCR)
- 4.2.7 Perform or simulate electrophoretic techniques and interpret electrophoresis fragmentation patterns

PERFORMANCE STANDARD 4.3 : PERFORM ENZYMOLOGY AND IMMUNOLOGY PROCEDURES

- 4.3.1 Describe how antibodies are formed and how they can be used in biotechnology applications
- 4.3.2 Investigate the use of antibody specificity for antigens to test for the presence of protein (e.g., ELISA, Western Blot, Antibody Staining)
- 4.3.3 Describe enzymes, the changes they cause in foods, and the physical and chemical parameters that affect enzymatic reactions

CONTENT STANDARD 5.0 : DEMONSTRATE THE APPLICATION OF BIOTECHNOLOGY TO
PERFORMANCE STANDARD 5.1 : EVALUATE THE APPLICATION OF GENETIC ENGINEERING TO IMPROVE PRODUCTS OF AFNR SYSTEMS
5.1.1 Explain biological, social, agronomic, and economic reasons for genetic modification of eukaryotes
5.1.2 Diagram the processes and describe the techniques used to produce transgenic eukaryotes
5.1.3 Compare and contrast the use of natural organisms and genetically engineered organisms in the treatment of wastes
5.1.4 Describe the benefits and risks associated with the use of biotechnology to increase productivity and improve quality of species
PERFORMANCE STANDARD 5.2 : PERFORM BIOTECHNOLOGY PROCESSES USED IN AFNR SYSTEMS
5.2.1 Explain the functions of hormones in animals
5.2.2 Describe the processes used to produce animal hormones from transgenic organisms
5.2.3 Compare and contrast bioengineering and conventional pathways used in food processing
5.2.4 Process food using biotechnological tools and applications
5.2.5 Explain the process of fermentation
5.2.6 Diagram the process used in producing biodiesel from biomass
5.2.7 Illustrate the process used in producing methane from biomass
PERFORMANCE STANDARD 5.3 : USE BIOTECHNOLOGY TO MONITOR AND EVALUATE PROCEDURES PERFORMED IN AFNR SYSTEMS
5.3.1 Compare and contrast selective breeding and genetic engineering approaches for crop and livestock improvement
5.3.2 Assess the benefits, risks, and opportunities associated with using biotechnology to promote animal health
5.3.3 Describe the use of biotechnology in bioremediation
5.3.4 Describe the processes involved in treatment of biological and industrial chemical wastes
5.3.5 Explain the trade-offs associated with agricultural biotechnology practices on wild populations and biodiversity
5.3.6 Define industrial biotechnology and describe the benefits and risks associated with its use in the manufacturing of food, fabrics, plastics, and other products

CONTENT STANDARD 6.0 : EXPLORE CAREERS IN AGRICULTURAL BIOTECHNOLOGY	
PERFORMANCE STANDARD 6.1 : ANALYZE REQUIREMENTS FOR CAREERS IN AGRICULTURAL BIOTECHNOLOGY	
6.1.1	Describe the educational requirements and responsibilities for various positions within the biotechnology/STEM industry
6.1.2	Develop a portfolio documenting education, experiences, and acquired skills for a specific career
6.1.3	Demonstrate understanding of the career development planning process and the process of life-long learning

CONTENT STANDARD 7.0 : SUPERVISED AGRICULTURAL EXPERIENCE (SAE)
PERFORMANCE STANDARD 7.1 : UNDERSTAND THE BENEFITS OF AN SAE PROGRAM
7.1.1 Accurately maintain SAE record books
7.1.2 Actively pursue individual achievement related to SAE area

CONTENT STANDARD 8.0 : LEADERSHIP TRAINING IN FFA	
PERFORMANCE STANDARD 8.1 : RECOGNIZE THE TRAITS OF EFFECTIVE LEADERS AND PARTICIPATE IN LEADERSHIP TRAINING THROUGH INVOLVEMENT IN FFA	
8.1.1	Expand leadership experience by serving as a chapter officer or on a committee
8.1.2	Exhibit leadership skills by demonstrating proper parliamentary procedure
8.1.3	Participate in a career development event, such as Agriscience Fair, Agriculture Issues, or related CDE, at the local level or above
8.1.4	Actively pursue necessary steps to receive higher degrees in FFA
PERFORMANCE STANDARD 8.2 : UNDERSTAND THE IMPORTANCE OF SCHOOL AND COMMUNITY AWARENESS	
8.2.1	Participate in a school improvement or community development project

CROSSWALKS AND ALIGNMENTS

CROSSWALKS (ACADEMIC STANDARDS)

The crosswalk of the Biotechnology Standards shows links to the Nevada Academic Content Standards in Science (based on the Next Generation Science Standards – Disciplinary Core Ideas Arrangement) and in English Language Arts and Mathematics (based on the Common Core State Standards). The crosswalk identifies the performance indicators in which the learning objectives in the Biotechnology program support academic learning. The performance indicators are grouped according to their content standard and are crosswalked to the Nevada Academic Content Standards in Science, English Language Arts, and Mathematics.

ALIGNMENTS (MATHEMATICAL PRACTICES)

In addition to correlation with the Nevada Academic Content Standards for Mathematics, many performance indicators support the Mathematical Practices. The following table illustrates the alignment of the Biotechnology Standards Performance Indicators and the Mathematical Practices. This alignment identifies the performance indicators in which the learning objectives in the Biotechnology program support academic learning.

ALIGNMENTS (SCIENCE AND ENGINEERING PRACTICES)

In addition to correlation with the Nevada Academic Content Standards for Science, many performance indicators support the Science and Engineering Practices. The following table illustrates the alignment of the Biotechnology Standards Performance Indicators and the Science and Engineering Practices. This alignment identifies the performance indicators in which the learning objectives in the Biotechnology program support academic learning.

CROSSWALKS (COMMON CAREER TECHNICAL CORE)

The crosswalk of the Biotechnology Standards shows links to the Common Career Technical Core. The crosswalk identifies the performance indicators in which the learning objectives in the Biotechnology program support the Common Career Technical Core. The Common Career Technical Core defines what students should know and be able to do after completing instruction in a program of study. The Biotechnology Standards are crosswalked to the Agriculture, Food & Natural Resources Career Cluster™ and the Animal & Plant Systems Career Pathways.

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CROSSWALK OF BIOTECHNOLOGY STANDARDS AND THE NEVADA ACADEMIC CONTENT STANDARDS

CONTENT STANDARD 1.0: RECOGNIZE THE HISTORICAL, SOCIAL, CULTURAL, AND POTENTIAL APPLICATIONS OF BIOTECHNOLOGY

Performance Indicators	Nevada Academic Content Standards
1.1.1	**English Language Arts: Language Standards** L.11-12.4 Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grades 11–12 reading and content, choosing flexibly from a range of strategies. **English Language Arts: Reading Standards for Informational Text** RI.11-12.3 Analyze a complex set of ideas or sequence of events and explain how specific individuals, ideas, or events interact and develop over the course of the text. RI.11-12.7 Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem. **English Language Arts: Reading Standards for Literature** RL.11-12.1 Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text, including determining where the text leaves matters uncertain. RL.11-12.4 Determine the meaning of words and phrases as they are used in the text, including figurative and connotative meanings; analyze the impact of specific word choices on meaning and tone, including words with multiple meanings or language that is particularly fresh, engaging, or beautiful. (Include Shakespeare as well as other authors.) RL.11-12.6 Analyze a case in which grasping point of view requires distinguishing what is directly stated in a text from what is really meant (e.g., satire, sarcasm, irony, or understatement). **English Language Arts: Writing Standards** W.11-12.9 Draw evidence from literary or informational texts to support analysis, reflection, and research.

Performance	Nevada Academic Content Standards
1.1.2	**English Language Arts: Reading Standards for Informational Text** RI.11-12.1 Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text, including determining where the text leaves matters uncertain. RI.11-12.3 Analyze a complex set of ideas or sequence of events and explain how specific individuals, ideas, or events interact and develop over the course of the text. RI.11-12.7 Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem. **English Language Arts: Writing Standards** W.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. W.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. W.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 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. W.11-12.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. **Science: HS-Engineering Design** HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Performance	Nevada Academic Content Standards
1.1.3	**English Language Arts: Speaking and Listening Standards** SL.11-12.1 Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively. SL.11-12.2 Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data. SL.11-12.4 Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. SL.11-12.5 Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. **English Language Arts: Writing Standards** W.11-12.1 Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence. W.11-12.1a 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 claim(s), counterclaims, reasons, and evidence. W.11-12.1b Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant evidence for each while pointing out the strengths and limitations of both in a manner that anticipates the audience's knowledge level, concerns, values, and possible biases. W.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 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. W.11-12.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. **Science: HS-Engineering Design** HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

Performance	Nevada Academic Content Standards
1.1.4	**English Language Arts: Writing Standards** W.11-12.1 Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence. W.11-12.2 Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content. W.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. W.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 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. W.11-12.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. **Science: HS-Biological Evolution: Unity and Diversity** HS-LS4-1 Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. HS-LS1-2 Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.
1.1.5	**English Language Arts: Speaking and Listening Standards** SL.11-12.1c Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives. SL.11-12.1d Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task. SL.11-12.2 Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data. **Science: HS-Biological Evolution: Unity and Diversity** HS-LS4-1 Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. HS-LS1-2 Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

Performance	Nevada Academic Content Standards
1.1.6	**Science: HS-Interdependent Relationships in Ecosystems** HS-LS2-1 Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales. HS-LS2-4 Matter and energy in organisms and ecosystems use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.
1.2.1	**English Language Arts: Speaking and Listening Standards** SL.11-12.4 Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. SL.11-12.5 Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.
1.2.2	**English Language Arts: Reading Standards for Literacy in Science and Technical Subjects** 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.11-12.2 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.11-12.10 By the end of grade 12, read and comprehend science/technical texts in the grades 11–CCR text complexity band independently and proficiently.

Performance	Nevada Academic Content Standards
1.2.3	**English Language Arts: Reading Standards for Literature** RL.11-12.1 Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text, including determining where the text leaves matters uncertain. **English Language Arts: Reading Standards for Literacy in Science and Technical Subjects** 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. **English Language Arts: Speaking and Listening Standards** SL.11-12.1 Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively. SL.11-12.1a Come to discussions prepared having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well - reasoned exchange of ideas. SL.11-12.4 Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. SL.11-12.5 Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. SL.11-12.6 Adapt speech to a variety of contexts and tasks, demonstrating a command of formal English when indicated or appropriate. (See grades 11–12 Language standards 1 and 3 on page 54 for specific expectations.)
1.3.1	**English Language Arts: Speaking and Listening Standards** SL.11-12.1d Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task. SL.11-12.4 Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks.

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1.3.2	**English Language Arts: Speaking and Listening Standards** SL.11-12.1 Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively. SL.11-12.2 Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data. SL.11-12.4 Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. SL.11-12.5 Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. **English Language Arts: Writing Standards** W.11-12.1 Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence. W.11-12.1a 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 claim(s), counterclaims, reasons, and evidence. W.11-12.1b Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant evidence for each while pointing out the strengths and limitations of both in a manner that anticipates the audience's knowledge level, concerns, values, and possible biases. W.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 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. W.11-12.9 Draw evidence from literary or informational texts to support analysis, reflection, and research.

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CONTENT STANDARD 2.0: DEMONSTRATE LABORATORY SAFETY PRACTICES

Performance Indicators	Nevada Academic Content Standards
2.1.1	**English Language Arts: Writing Standards** W.11-12.2 Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content. W.11-12.2d Use precise language, domain-specific vocabulary, and techniques such as metaphor, simile, and analogy to manage the complexity of the topic. W.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. W.11-12.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.
2.1.2	**English Language Arts: Reading Standards for Literacy in Science and Technical Subjects** 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.11-12.4 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. RST.11-12.5 Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas. RST.11-12.6 Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved. 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.
2.1.3	**English Language Arts: Reading Standards for Literacy in Science and Technical Subjects** 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.
2.1.4	**English Language Arts: Reading Standards for Literacy in Science and Technical Subjects** 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. **English Language Arts: Writing Standards** W.11-12.9 Draw evidence from literary or informational texts to support analysis, reflection, and research.
2.2.1	**English Language Arts: Reading Standards for Literacy in Science and Technical Subjects** 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. 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.

Performance	Nevada Academic Content Standards
2.2.2	**English Language Arts: Writing Standards** W.11-12.2 Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.
2.2.3	**English Language Arts: Reading Standards for Literacy in Science and Technical Subjects** 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. 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.
2.2.4	**English Language Arts: Reading Standards for Literacy in Science and Technical Subjects** 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. 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.
2.3.2	**Science: HS-From Molecules to Organisms: Structures and Processes** HS-LS1-1 Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.
2.3.3	**Science: HS-Biological Evolution: Unity and Diversity** HS-LS4-1 Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. HS-LS4-2 Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment. HS-LS4-3 Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait. HS-LS4-4 Construct an explanation based on evidence for how natural selection leads to adaptation of populations. HS-LS4-5 Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species. HS-LS4-6 Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.
2.3.4	**Science: HS-From Molecules to Organisms: Structures and Processes** HS-LS1-1 Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.

Performance	Nevada Academic Content Standards
2.3.8	**Science: HS-Engineering Design** HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

CONTENT STANDARD 3.0: DEMONSTRATE LABORATORY SKILLS AS APPLIED TO BIOTECHNOLOGY

Performance Indicators	Nevada Academic Content Standards
3.1.1	**Science: HS-Engineering Design** HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts. **Science: HS-Heredity: Inheritance and Variation of Traits** HS-LS3-1 Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring. HS-LS3-2 Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors. HS-LS3-3 Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.
3.1.2	**Science: HS-From Molecules to Organisms: Structures and Processes** HS-LS1-1 Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells. HS-LS1-2 Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms. HS-LS1-4 Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms. **Science: HS-Engineering Design** HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

Performance	Nevada Academic Content Standards
3.1.3	**Science: HS-From Molecules to Organisms: Structures and Processes** HS-LS1-7 Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy. **Science: HS-Engineering Design** HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
3.1.4	**Science: HS-Ecosystems: Interactions, Energy, and Dynamics** HS-LS2-3 Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions. **Science: HS-Engineering Design** HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
3.1.5	**Science: HS-Ecosystems: Interactions, Energy, and Dynamics** HS-LS2-6 Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem. HS-LS2-7 Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity. **Science: HS-Biological Evolution: Unity and Diversity** HS-LS4-5 Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species. HS-LS4-6 Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.
3.2.2	**Science: HS-From Molecules to Organisms: Structures and Processes** HS-LS1-1 Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.

Performance	Nevada Academic Content Standards
3.2.3	**Science: HS-Engineering Design** HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
3.2.4	**Science: HS-Engineering Design** HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
3.2.5	**Science: HS-Ecosystems: Interactions, Energy, and Dynamics** HS-LS2-3 Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions. **Science: HS-From Molecules to Organisms: Structures and Processes** HS-LS1-5 Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy. **Science: HS-Engineering Design** HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
3.2.6	**Science: HS-Ecosystems: Interactions, Energy, and Dynamics** HS-LS2-3 Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions. **Science: HS-From Molecules to Organisms: Structures and Processes** HS-LS1-5 Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy. **Science: HS-Engineering Design** HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

Performance	Nevada Academic Content Standards
3.2.7	**Science: HS-Engineering Design** HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts. **Science: HS-From Molecules to Organisms: Structures and Processes** HS-LS1-5 Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy. **Science: HS-Ecosystems: Interactions, Energy, and Dynamics** HS-LS2-3 Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.
3.3.1	**Science: HS-Heredity: Inheritance and Variation of Traits** HS-LS3-1 Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring. HS-LS3-2 Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors. HS-LS3-3 Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population. **Science: HS-Biological Evolution: Unity and Diversity** HS-LS4-3 Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait. HS-LS4-4 Construct an explanation based on evidence for how natural selection leads to adaptation of populations.
3.3.2	**Science: HS-Engineering Design** HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

Performance	Nevada Academic Content Standards
3.3.3	**Science: HS-Engineering Design** HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
3.3.4	**Science: HS-Engineering Design** HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
3.3.5	**Science: HS-Ecosystems: Interactions, Energy, and Dynamics** HS-LS2-6 Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem. **Science: HS-Biological Evolution: Unity and Diversity** HS-LS4-4 Construct an explanation based on evidence for how natural selection leads to adaptation of populations.
3.3.6	**Science: HS-Ecosystems: Interactions, Energy, and Dynamics** HS-LS2-6 Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem. HS-LS2-7 Design, evaluate and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
3.3.7	**Science: HS-Engineering Design** HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

CONTENT STANDARD 4.0: PERFORM MICROBIOLOGY, MOLECULAR BIOLOGY, ENZYMOLOGY, AND IMMUNOLOGY PROCEDURES

Performance Indicators	Nevada Academic Science Content Standards
4.1.1	**Science: HS-Ecosystems: Interactions, Energy, and Dynamics** HS-LS2-8 Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce. **Science: HS-Biological Evolution: Unity and Diversity** HS-LS4-6 Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.
4.1.2	**Science: HS-Ecosystems: Interactions, Energy, and Dynamics** HS- LS2-1 Use mathematical and/or computations representations to support explanations of factors that affect carrying capacity of ecosystems at different scales. HS-LS2-2 Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. HS-LS2-6 Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem. HS-LS2-7 Design, evaluate, and refine a solution of reducing the impacts of human activities on the environment and biodiversity.
4.2.1	**Science: HS-Ecosystems: Interactions, Energy, and Dynamics** HS-LS2-1 Use mathematical and/or computations representations to support explanations of factors that affect carrying capacity of ecosystems at different scales. HS-LS2-2 Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. HS-LS2-6 Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem. HS-LS2-7 Design, evaluate, and refine a solution of reducing the impacts of human activities on the environment and biodiversity.
4.2.2	**Science: HS-Heredity: Inheritance and Variation of Traits** HS-LS3-1 Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring. HS-LS3-2 Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors. HS-LS3-3 Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.

Performance Indicators	Nevada Academic Science Content Standards
4.2.3	**Science: HS-From Molecules to Organisms: Structures and Processes** HS-LS1-1 Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.
4.2.4	**Science: HS-Heredity: Inheritance and Variation of Traits** HS-LS3-2 Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors. HS-LS3-3 Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.
4.2.5	**Science: HS-Matter and Its Interactions** HS-PS1-2 Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.
4.2.6	**Science: HS-Matter and Its Interactions** HS-PS1-2 Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. HS-PS1-6 Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium. **Science: HS-Heredity: Inheritance and Variation of Traits** HS-LS3-3 Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.
4.2.7	**Science: HS-Matter and Its Interactions** HS-PS1-4 Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy. **Science: HS-Energy** HS-PS3-4 Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).
4.3.1	**Science: HS-Earth and Human Activity** HS-ESS2-4 Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate. **Science: HS-Engineering Design** HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. **Science: HS-Heredity: Inheritance and Variation of Traits** HS-LS3-1 Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring. HS-LS3-2 Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.

Performance Indicators	Nevada Academic Content Standards
4.3.2	**Science: HS-Matter and Its Interactions** HS-PS1-2 Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.
4.3.3	**Science: HS-Earth's Systems** HS-ESS2-3 Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection. HS-ESS2-4 Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.

CONTENT STANDARD 5.0: DEMONSTRATE THE APPLICATION OF BIOTECHNOLOGY TO AGRICULTURE, FOOD, AND NATURAL RESOURCES (AFNR)

Performance Indicators	Nevada Academic Science Content Standards
5.1.1	**Science: HS-Ecosystems: Interactions, Energy, and Dynamics** HS-LS2-8 Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce. **Science: HS-Biological Evolution: Unity and Diversity** HS-LS4-6 Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.
5.1.2	**Science: HS-Ecosystems: Interactions, Energy, and Dynamics** HS-LS2-1 Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales. HS-LS2-2 Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
5.1.3	**Science: HS-Ecosystems: Interactions, Energy, and Dynamics** HS-LS2-6 Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem. HS-LS2-7 Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
5.1.4	**Science: HS-From Molecules to Organisms: Structures and Processes** HS-LS1-4 Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms. **Science: HS-Heredity: Inheritance and Variation of Traits** HS-LS3-1 Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring. HS-LS3-2 Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors. HS-LS3-3 Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.
5.2.1	**Science: HS-Biological Evolution: Unity and Diversity** HS-LS4-1 Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. HS-LS4-2 Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment. HS-LS4-4 Construct an explanation based on evidence for how natural selection leads to adaptation of populations.

Performance Indicators	Nevada Academic Content Standards
5.2.2	**Science: HS-Heredity: Inheritance and Variation of Traits** HS-LS3-3 Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.
5.2.3	**Science: HS-Engineering Design** HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
5.2.4	**Science: HS-Matter and Its Interactions** HS-PS1-6 Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.
5.2.5	**Science: HS-Matter and Its Interactions** HS-PS1-4 Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy. HS-PS1-5 Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs. **Science: HS-Ecosystems: Interactions, Energy, and Dynamics** HS-LS2-3 Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions. HS-LS2-4 Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. HS-LS2-7 Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
5.2.6	**Science: HS-Matter and Its Interactions** HS-PS1-2 Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. **Science: HS-Energy** HS-PS3-3 Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.
5.2.7	**Science: HS-Matter and Its Interactions** HS-PS1-2 Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. HS-PS1-7 Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. **Science: HS-Energy** HS-PS3-3 Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.
5.3.1	**Science: HS-Heredity: Inheritance and Variation of Traits** HS-LS3-1 Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.

Performance Indicators	Nevada Academic Content Standards
5.3.2	**Science: HS-From Molecules to Organisms: Structures and Processes** HS-LS1-1 Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells. HS-LS1-2 Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.
5.3.3	**Science: HS-Energy** HS-PS3-1 Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known. HS-PS3-4 Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).
5.3.4	**Science: HS-Energy** HS-PS3-1 Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known. HS-PS3-4 Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).
5.3.5	**Science: HS-Ecosystems: Interactions, Energy, and Dynamics** HS-LS2-6 Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem. **Science: HS-Heredity: Inheritance and Variation of Traits** HS-LS3-3 Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population. **Science: HS-Biological Evolution: Unity and Diversity** HS-LS4-4 Construct an explanation based on evidence for how natural selection leads to adaptation of populations.

Performance Indicators	Nevada Academic Content Standards
5.3.6	**Science: HS-Biological Evolution: Unity and Diversity** HS-LS4-5 Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species. **Science: HS-Matter and Its Interactions** HS-PS1-1 Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms. **Science: HS-Energy** HS-PS3-3 Design, build and refine a device that works within given constraints to convert one form of energy into another form of energy. **Science: HS-Engineering Design** HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

CONTENT STANDARD 6.0: EXPLORE CAREER OPPORTUNITIES IN AGRICULTURAL BIOTECHNOLOGY

Performance Indicators	Nevada Academic Content Standards
6.1.1	**English Language Arts: Writing Standards for Literacy in Science and Technical Subjects** 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 understand of the subject under investigation.
6.1.2	**English Language Arts: Writing Standards for Literacy in Science and Technical Subjects** 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 understand of the subject under investigation.
6.1.3	**English Language Arts: Reading Standards for Literacy in Science and Technical Subjects** 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. **English Language Arts: Writing Standards for Literacy in Science and Technical Subjects** WHST.11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. **English Language Arts: Speaking and Listening Standards** SL.11-12.1c Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives. SL.11-12.1d Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task. SL.11-12.2 Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data.

CONTENT STANDARD 7.0: SUPERVISED AGRICULTURAL EXPERIENCE (SAE)

Performance Indicators	Nevada Academic Content Standards
7.1.1	**English Language Arts: Writing Standards for Literacy in Science and Technical Subjects** WHST.11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
7.1.2	**English Language Arts: Writing Standards for Literacy in Science and Technical Subjects** WHST.11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. **English Language Arts: Reading Standards for Literacy in Science and Technical Subjects** 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.

CONTENT STANDARD 8.0: LEADERSHIP TRAINING IN FFA

Performance Indicators	Nevada Academic Content Standards
8.1.1	**English Language Arts: Speaking and Listening Standards** SL.11-12.1b Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed.
8.1.2	**English Language Arts: Speaking and Listening Standards** SL.11-12.6 Adapt speech to a variety of contexts and tasks, demonstrating a command of formal English when indicated or appropriate. (See grades 11–12 Language standards 1 and 3 on page 54 for specific expectations.)
8.1.3	**English Language Arts: Speaking and Listening Standards** SL.11-12.1d Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task. SL.11-12.2 Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data. SL.11-12.6 Adapt speech to a variety of contexts and tasks, demonstrating a command of formal English when indicated or appropriate. (See grades 11–12 Language standards 1 and 3 on page 54 for specific expectations.)
8.1.4	**English Language Arts: Speaking and Listening Standards** SL.11-12.1c Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives. SL.11-12.1d Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task. SL.11-12.2 Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data. SL.11-12.6 Adapt speech to a variety of contexts and tasks, demonstrating a command of formal English when indicated or appropriate. (See grades 11–12 Language standards 1 and 3 on page 54 for specific expectations.) **English Language Arts: Writing Standards for Literacy in Science and Technical Subjects** WHST.11-12.4 Produce a clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
8.2.1	**English Language Arts: Speaking and Listening Standards** SL.11-12.1b Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed.

ALIGNMENT OF BIOTECHNOLOGY STANDARDS AND THE MATHEMATICAL PRACTICES

Mathematical Practices	Biotechnology Performance Indicators
1. Make sense of problems and persevere in solving them.	1.3.1-1.3.3 4.2.4
2. Reason abstractly and quantitatively.	1.1.5 5.3.5, 5.3.6
3. Construct viable arguments and critique the reasoning of others.	1.3.1-1.3.3 5.3.1, 5.3.2
4. Model with mathematics.	3.1.3, 3.1.4
5. Use appropriate tools strategically.	2.2.1, 2.2.2, 2.2.5 4.2.3, 4.2.6, 4.2.7
6. Attend to precision.	2.2.5 3.1.1, 3.1.2; 3.2.1, 3.2.5
7. Look for and make use of structure.	5.3.3, 5.3.4, 5.3.6
8. Look for and express regularity in repeated reasoning.	1.3.1-1.3.3

ALIGNMENT OF BIOTECHNOLOGY STANDARDS AND THE SCIENCE AND ENGINEERING PRACTICES

Science and Engineering Practices	Biotechnology Performance Indicators
1. Asking questions (for science) and defining problems (for engineering).	1.1.1, 1.1.2
2. Developing and using models.	1.3.2, 1.3.3
3. Planning and carrying out investigations.	2.2.5 3.2.2
4. Analyzing and interpreting data.	3.1.3, 3.1.4
5. Using mathematics and computational thinking.	3.2.2, 3.2.5
6. Constructing explanations (for science) and designing solutions (for engineering).	3.1.3, 3.1.4
7. Engaging in argument from evidence.	1.3.1-1.3.3 5.3.6
8. Obtaining, evaluating, and communicating information.	6.1.3 7.1.1

CROSSWALKS OF BIOTECHNOLOGY STANDARDS AND THE COMMON CAREER TECHNICAL CORE

Agriculture, Food & Natural Resources Career Cluster™ (AG)	Performance Indicators
1. Analyze how issues, trends, technologies and public policies impact systems in the Agriculture, Food & Natural Resources Career Cluster™.	1.1.1-1.1.5
2. Evaluate the nature and scope of the Agriculture, Food & Natural Resources Career Cluster™ and the role of agriculture, food and natural resources (AFNR) in society and the economy.	1.2.1-1.2.3
3. Examine and summarize the importance of health, safety and environmental management systems in AFNR businesses.	1.3.1-1.3.3; 2.1.1
4. Demonstrate stewardship of natural resources in AFNR activities.	1.2.2-1.2.3; 1.3.2
5. Describe career opportunities and means to achieve those opportunities in each of the Agriculture, Food & Natural Resources Career Pathways.	6.1.1-6.1.3
6. Analyze the interaction among AFNR systems in the production, processing and management of food, fiber and fuel and the sustainable use of natural resources.	5.1.3-5.1.4; 5.3.1, 5.3.3 5.3.5-5.3.6

Animal Systems Career Pathway (AG-ANI)	Performance Indicators
1. Analyze historic and current trends impacting the animal systems industry.	1.3.1-1.3.3
2. Utilize best-practice protocols based upon animal behaviors for animal husbandry and welfare.	4.1.1; 5.1.4
3. Design and provide proper animal nutrition to achieve desired outcomes for performance, development, reproduction and/or economic production.	1.1.1, 1.1.3, 1.1.5
4. Apply principles of animal reproduction to achieve desired outcomes for performance, development and/or economic production.	5.1.4; 5.3.1-5.3.2
5. Evaluate environmental factors affecting animal performance and implement procedures for enhancing performance and animal health.	1.1.1, 1.1.4-1.1.5
6. Classify, evaluate and select animals based on anatomical and physiological characteristics.	4.1.1; 4.2.1-4.2.4
7. Apply principles of effective animal health care.	4.3.1-4.3.2; 5.3.2

Plant Systems Career Pathway (AG-PL)	Performance Indicators
1. Develop and implement a crop management plan for a given production goal that accounts for environmental factors.	3.1.1-3.1.4
2. Apply the principles of classification, plant anatomy and plant physiology to plant production and management.	1.1.2-1.1.5
3. Propagate, culture and harvest plants and plant products based on current industry standards.	5.1.3-5.1.4
4. Apply principles of design in plant systems to enhance an environment (e.g., floral, forest, landscape and farm).	5.3.3-5.3.4