APS DISTRICT HIGH SCHOOL SCIENCE CURRICULUM FRAMEWORK

Course Title: Biology II **Course Number:** 44111

Department: Science **ADS Number:** 17124944

Prerequisites: Successful completion of one year Biology and one year Chemistry or Physics with a grade of C or better

Length of Course: One Year **Credit/PRI Area:** .50 per Sem/Elective **Grade Level(s):** 11-12

Important Notes:

COURSE DESCRIPTION: This laboratory course* is designed as a combination of acceleration and enrichment emphasizing in depth study of the fundamental principles, problems, and subfields of biology. The student who selects this course has already met life science standards. Topics covered vary but must include two different focuses that may include, but are not limited to, botany, environmental studies, genetics, microbiology, comparative anatomy, and cytology or other topics left to the teacher's discretion. A research paper and/or a science project may be required. Literacy strategies (e.g., reading, writing, speaking) are integrated throughout the curriculum.

*Lab Courses: A minimum of 250 minutes per week of directed class activity for 36 weeks, 40% of which must be lab oriented, for a total of 150 clock hours (90 hours of class plus 60 hours of lab) shall be required for one (1) unit of credit, excluding passing period. [APS Procedural Directives, Section I – Instruction, Basis for offering credit].

References in parentheses following each performance standard refer to and align with the State of New Mexico Science Standards (NM), the Albuquerque Public Schools Mathematics Standards (APS – MA), and the Albuquerque Public Schools Language Arts Standards (APS - LA).

STRATEGIES:
The "Illustrations" column in the *Program of Studies* provides exemplars of the performance standards, strategies, and best practices suggested by the science teachers in the Albuquerque Public Schools (APS).

ASSESSMENTS:
Assessments may include the following: authentic and performance-based assessment, cooperative learning, teacher observations, checklists, tests and exams, formal and informal writing, small group and full class discussions, oral and multimedia presentations, projects, demonstrations, and portfolios. Assessments are based on appropriate rubrics.

SUGGESTED TEXTBOOKS AND INSTRUCTIONAL MATERIALS:
- Current state adopted science textbooks
- Supplementary materials
- Computers
- Computer software
- Microscopes
- Dissecting kits
- *Microbiology* – Prescott et al. – Harcourt Brace – 5th edition
- *Flowering Plants of New Mexico* – DeWitt-Ivey, Robert – Rio Rancho Press

SUGGESTED TITLES/AUTHORS WEB SITES:

Approved by HSCA: 12/04

STRAND I: SCIENTIFIC THINKING AND PRACTICE
CONTENT STANDARD: The student understands the processes of scientific investigations and uses inquiry and scientific ways of observing, experimenting, predicting, and validating to think critically.

BENCHMARKS: A. The student uses accepted scientific methods to collect, analyze, and interpret data and observations and to design and conduct scientific investigations and communicate results.
B. The student understands that scientific processes produce scientific knowledge that is continually evaluated, validated, revised, or rejected.

GRADE 11-12	PERFORMANCE STANDARDS	ILLUSTRATIONS
	1. Describes the essential components of an investigation, including appropriate methodologies, proper equipment, and safety precautions (NM – I.I.I.1). 2. Designs and conducts scientific investigations that include (NM – I.I.I.2): • testable hypotheses, • controls and variables, • methods to collect, analyze, and interpret data, • results that address hypotheses being investigated, • predictions based on results, • re-evaluation of hypotheses and additional experimentation as necessary, and • error analysis. 3. Uses appropriate technologies to collect, analyze, and communicate scientific data (e.g., computers, calculators, balances, microscopes) (NM – I.I.I.3). 4. Conveys results of investigations using scientific concepts, methodologies, and expressions, including (NM – I.I.I.4; APS – MA IV.5E): • scientific language and symbols, • diagrams, charts, and other data displays, • mathematical expressions and processes (e.g., mean, median, slope, proportionality), • clear, logical, and concise communication, and • reasoned arguments.	**NOTE: Illustrations include suggested activities for attaining each performance standard. A check (√) refers to a key feature to look for while assessing student performance.** 1 – 7. The student properly designs and performs a controlled experiment using a recognized scientific method, gathers data, and reports results in both an oral and written format. ✓ proper safety techniques ✓ correct use of equipment ✓ appropriate equipment ✓ evidence of current scientific knowledge ✓ effective communication skills ✓ use of technology ✓ quantitative data ✓ critical thinking and insights

GRADE 11-12	PERFORMANCE STANDARDS	ILLUSTRATIONS
	5. Understands how scientific processes produce valid, reliable results, including (NM – I.I.II.1): • consistency of explanations with data and observations, • openness to peer review, • full disclosure and examination of assumptions, • testability of hypotheses, and • repeatability of experiments and reproducibility of results. 6. Understands how new data and observations can result in new scientific knowledge (NM – I.I.II.3; APS – MA IV.1E). 7. Critically analyzes an accepted explanation by reviewing current scientific knowledge (NM – I.I.II.4).	

STRAND II: CONTENT OF SCIENCE – LIFE SCIENCE
CONTENT STANDARD: The student understands the properties, structures, and processes of living things and the interdependence of living things and their environments.

BENCHMARKS: A. The student understands how the survival of species depends on biodiversity and on complex interactions, including the cycling of matter and the flow of energy.
B. The student understands the genetic basis for inheritance and the basic concepts of biological evolution.
C. The student understands the characteristics, structures, and functions of cells.

GRADE 11-12	PERFORMANCE STANDARDS	ILLUSTRATIONS
	BOTANY	**BOTANY**
	1. Identifies and describes structures, functions, reproduction, life cycles, and evolution of simple as well as higher plants (NM – II.II.I.8, II.II.III. 1-3).	1. Through presentation of lecture, current literature, text, video, and lab activities, the student may study the following topics: plant evolution and classification (nonvascular through vascular); plant cells and tissues; structure and function of roots, stems, and leaves; plant life cycles; sexual and asexual reproduction; seed dispersal and propagation; and plant responses to environment. The student engages in a variety of activities unique to each topic that range from experimentation to oral and written presentations. ✓ individual participation ✓ comprehension of main ideas ✓ writing and/or speaking conventions ✓ effective presentation ✓ adherence to specified guidelines
	2. Relates and discusses the ecological interactions of plants, including a collection and identification of selected flora of New Mexico (NM – II.II.I.1, II.II.I.8).	2. Through in class labs, on and off campus field trips, and independent student field work, the student produces a collection of New Mexico flora that includes the following: properly mounted specimens of a variety of native families, proper specimen labels, and original field notes. ✓ correct identification of plants ✓ documentation of work ✓ completion of all components of the task
	3. Lists and discusses the importance of plants for industrial, agricultural, and medicinal purposes (NM – II.II.I.4, III.I.I.3-5, III.I.I.12).	3. The student learns about plants and people through lecture, video, current literature, or independent study. Working alone or in groups, the student researches a plant or a plant's family importance in industry, agriculture, or medicine and presents (e.g., research paper, oral presentation, video presentation, poster) findings to the class. ✓ thoroughness of research ✓ reading analysis ✓ relevance

GRADE 11-12	PERFORMANCE STANDARDS	ILLUSTRATIONS
		✓ all required components ✓ effective presentation
	ENVIRONMENTAL STUDIES 4. Examines the diversity of living organisms within ecosystems (NM – II.II.I.1, II.II.I.2). 5. Identifies and analyzes characteristics of different ecosystems including abiotic and biotic factors (NM – II.II.I.3, II.II.I.5). 6. Identifies and analyzes cycles of matter and energy in the environment (NM – II.II.I.5-7, II.III.II.1, II.III.II.8, II.III.II.9).	**ENVIRONMENTAL STUDIES** 4 – 6. Building on the student's background knowledge of population dynamics, species interactions, properties of communities, succession, energy transfer, ecosystem recycling, abiotic and biotic interactions, and human impact on the environment, the student engages in a project of a New Mexico ecosystem that may include the following: survey of community populations, including species distribution; analysis of abiotic factors (e.g., soil moisture content, temperature variation); determination of average biomass; and a lab report of collected data, including analysis of species adaptations for the ecosystem studied. ✓ inclusion of all required components ✓ understanding of an ecosystem ✓ analysis ✓ documentation of work
	GENETICS 7. Demonstrates an in-depth understanding of the basic laws of heredity (NM – II.II.II.1-3 and 5-7).	**GENETICS** 7. Through a review and further study of Mendel's Laws (e.g., classic Mendelian ratios, nonMendelian genetics, chromosome mapping, linkage groups), the student engages in a variety of lab activities (e.g., fruit flies, corn, Wisconsin Fast Plants), that allow the student to demonstrate understanding of those laws. ✓ comprehension of the laws ✓ proper lab techniques ✓ data collection ✓ data analysis OR The student collects data from classmates, family members, and relatives and distinguishes inheritance of traits based on phenotypic ratios. He/She describes/explains why some traits are present in higher numbers than others or why the trait is in some family members but not others. The student looks for a trait (e.g., attached ear lobe, interlacing fingers, widow's peak), compares the actual ratio to the expected ratio, does a Punnett Square, and analyzes the results. Prior to this activity the student learns the proper vocabulary.

GRADE 11-12	PERFORMANCE STANDARDS	ILLUSTRATIONS
		✓ understanding of vocabulary ✓ correct ratios ✓ identification of traits ✓ trait understudy is the result of dominant/recessive ✓ genes are segments of DNA ✓ analysis of results
	8. Understands the principles of genetic engineering (NM – III.I.I.1-3, 5, 11, 15 – 19). 9. Utilizes basic laws of heredity and the understanding of genetic engineering to analyze past, present, and future issues (NM – III.I.I.1-3, 5, 11, 15 – 19).	8, 9. The student researches the use of genetic engineering in medicine (e.g., diabetes), compares it to the past, and determines the use of genetic engineered plants and animals for the future. He/She uses the information to prepare an oral or multimedia presentation. ✓ thorough research ✓ relevant information ✓ comparisons ✓ applications ✓ effective presentation Extension: Depending on the availability of the school's resources, the student uses BSCS programs on the Human Genome and Inheritance projects (e.g., family pedigrees).
	MICROBIOLOGY 10. Categorizes microorganisms in the basis of their cultural and morphological characteristics (NM – II.II.I.8, II.II.III.2). 11. Recognizes that classification is a fluid process based on technological advances and scientific collaboration (NM – I.I.II.1, I.I.II.3, III.I.I.2, III.I.I.6, III.I.I.10). 12. Demonstrates microbiological techniques by growing and maintaining microorganisms (NM – I.I.I.1, I.I.I.3, I.I.I.4).	**MICROBIOLOGY** 10 – 12. The student identifies phylum and class of various microorganisms (e.g., bacteria, fungi, protists) through a variety of lab activities that utilize simple staining, slide preparation, and Gram stain techniques. ✓ appropriate aseptic technique ✓ proper specimen identification ✓ data collection ✓ analysis
	13. Discusses the importance of microorganisms in nature, medicine, and industry (NM – III.I.I.3, III.I.I.5).	13. The student researches various microbe-caused diseases (e.g., polio) or the use of microbes in industry (e.g., food manufacturing) and uses the findings to make a class presentation (e.g., video, poster, oral, written). ✓ thorough research ✓ relevant information ✓ organization ✓ powerful presentation

GRADE 11-12	PERFORMANCE STANDARDS	ILLUSTRATIONS
	COMPARATIVE ANATOMY 14. Compares the design and function of major systems of each species dissected (NM – II.II.I.8, II.II.I.9, II.II.II.13). 15. Recognizes major evolutionary trends in body structures leading to higher vertebrates (NM - II.II.I.8, II.II.II.13).	**COMPARATIVE ANATOMY** 14, 15. The student creates a chart development of specific organs (e.g., heart) to emphasize evolutionary advances. OR Through the study of the major systems (e.g., digestive, circulatory, excretory, respiratory), as well as the phylogenetical relationships of the selected groups of organisms, the student produces a portfolio that includes informational sections of each group of organism studied. Sections may include the following: general group characteristics and examples (e.g., pictures), phylogenetic trees, unique evolutionary adaptations, lab reports, labeled diagrams of systems, and current/historical importance to humans. ✓ a variety of entries ✓ required documentations ✓ organization and analysis ✓ thoroughness and accuracy ✓ effective communication ✓ quality product
	CYTOLOGY 16. Describes the ultrastructure of cells and basic physiological and biochemical functions of organelles and cytoplasm (NM – II.II.II.1-7).	**CYTOLOGY** 16. The student engages in a variety of lab activities to enhance his/her understanding of cell structure and function (i.e., prokaryotic, eukaryotic) including homeostasis, energy flow, DNA replication, transcription, and cell reproduction. ✓ proper microscope use ✓ staining technique ✓ knowledge of cell physiology ✓ analysis
	17. Traces the evolutionary development from early organic compounds to viruses, bacteria, and protists (NM – II.II.II.8-13).	17. Using what the student has learned in the previous illustration on cell study, the student develops a timeline or portfolio showing the evolution of life on Earth. The information required or the way the student chooses to present the information may vary. For example, the student may use pictures along his timeline to represent his/her information. ✓ creativity or originality ✓ all required components ✓ effective presentation Extension: The student uses the Microcosmos program and/or builds Winogradski columns.

STRAND III: SCIENCE IN SOCIETY
CONTENT STANDARD: The student understands how scientific discoveries, inventions, practices, and knowledge influence and are influenced by individuals and societies.

BENCHMARK: The student examines and analyzes how scientific discoveries and their applications affect the world and explains how societies influence scientific investigations and applications.

GRADE 11-12	PERFORMANCE STANDARDS	ILLUSTRATIONS
	1. Knows how science enables technology but also constrains it, and recognizes the difference between real technology and science fiction (e.g., rockets vs. antigravity machines, nuclear reactors vs. perpetual-motion machines, medical X-rays vs. Star-Trek tricorders) (NM – III.I.I.1). 2. Understands how advances in technology enable further advances in science (e.g., microscopes and cellular structure, telescopes and understanding of the universe) (NM – III.I.I.2). 3. Evaluates the influences of technology on society (e.g., communications, petroleum, transportation, nuclear energy, computers, medicine, genetic engineering) including both desired and undesired effects, including some historical examples (e.g., the wheel, the plow, the printing press, the lightning rod) (NM – III.I.I.3). 4. Understands the scientific foundations of common technologies (e.g., kitchen appliances, radio, television, aircraft, rockets, computers, medical X-rays, selective breeding, fertilizers and pesticides, agricultural equipment) (NM – III.I.I.4). 5. Understands that applications of genetics can meet human needs and can create new problems (e.g., agriculture, medicine, cloning) (NM – III.I.I.5). (Specific to the genetics topic) 6. Analyzes the impact of digital technologies on the availability, creation, and dissemination of information (NM – III.I.I.6). 7. Describes major historical changes in scientific perspectives (e.g., atomic theory, germs, cosmology, relativity, plate tectonics, evolution) and the experimental observations that triggered them (NM – III.I.I.10).	1 – 15. The student researches a particular technological advance (e.g., cloning, computers "as scientists") and either orally or in a written format presents the origin of the technology and the pros and cons of the development. ✓ thorough research ✓ specific technological citations ✓ accuracy ✓ impact of the development ✓ evolutionary changes ✓ analysis and organization ✓ effective presentation 5, 11 – 13. The student examines current news items (e.g., articles, TV, newspapers) on bioethics issues (e.g., cloning, stem cell research). In small or large group discussions, the student discusses the particular stances, what ideas are out there, and benefits of having the information or advancement of the new knowledge. ✓ accurate account of news items ✓ different viewpoints

GRADE 11-12	PERFORMANCE STANDARDS	ILLUSTRATIONS
	8. Knows that societal factors can promote or constrain scientific discovery (e.g., government funding, laws and regulations about human cloning and genetically modified organisms, gender and ethnic bias, AIDS research, alternative-energy research) (NM – III.I.I.11). 9. Explains how societies can change ecosystems and how these changes can be reversible or irreversible (NM – III.I.I.12). (Specific to Environmental Studies topic) 11. Identifies how science has produced knowledge that is relevant to individual health and material prosperity (NM – III.I.I.15). 12. Understands that reasonable people may disagree about some issues that are of interest to both science and religion (e.g., the origin of life on Earth, the cause of the Big Bang, the future of Earth) (NM – III.I.I.16). 13. Identifies important questions that science cannot answer (e.g., questions that are beyond today's science, decisions that science can only help to make, questions that are inherently outside of the realm of science) (NM – III.I.I.17). 14. Understands that scientists have characteristics in common with other individuals (e.g., employment and career needs, curiosity, desire to perform public service, greed, preconceptions and biases, temptation to be unethical, core values including honesty and openness) (NM – III.I.I.18). 15. Knows that science plays a role in many different kinds of careers and activities (e.g., public service, volunteers, public office holders, researchers, teachers, doctors, nurses, technicians, farmers, ranchers) (NM – III.I.I.19).	8, 9, 15. **Note:** The activity that is about to be described has no time limitations. It can be done as a short term project or extended to cover a semester or year. Depending on the time frame, the number of items that a student has to collect can vary from 5 to 25 or 50 and can include news reports. The student participates in a "Science in the News Project." He/She collects print articles (e.g., on-line, magazines), cuts them out, and compiles them in a format (e.g., binder, notebook, folder) that allows him/her to write beneath each article a 25-50 word abstract, a critique of the article, and relate its application to the student's daily life. At the end of the collection time period, each student shares with the class the article that most impressed him/her and tells why. After the presentation the student can address questions from the other students relating to the article. ✓ thoroughness ✓ appropriateness of articles ✓ reading analysis ✓ brevity ✓ organization of work ✓ clear communication ✓ personal connections ✓ individual participation in discussions ✓ response to questions ✓ audience response ✓ effective presentation

STRAND IV: LITERACY
CONTENT STANDARD: The student communicates scientific principles through reading, writing, speaking, and research opportunities.

BENCHMARK: The student demonstrates proficiency in reading comprehension, specialized vocabulary, and a variety of writing and speaking requirements.

GRADE 11-12	PERFORMANCE STANDARDS	ILLUSTRATIONS
		Note: The very nature of science courses entails that the student be involved in research, exploration, and experimentation. This requires the student to read through his/her research studies; write up findings in the form of lab reports; work with other students collaboratively, requiring whole or small group discussions; listen to others' viewpoints whether it be through print, video, or guest speaker; and display data in an organized fashion. Consequently, literacy strategies are reflected in every strand. The following citations illustrate specific examples of these strategies; although, numerous opportunities are presented throughout the year and throughout the curriculum.
	1. Develops and demonstrates proficiency with the following strategies to approach reading for information across content areas (APS – LA I.1): • scans reading selection to determine whether a text contains relevant information, • uses the headings and subheadings of the material to make predictions and to validate comprehension of text, • reads and rereads to decode meaning, and • reviews and summarizes essential elements of text for overview. 2. Identifies and uses roots, prefixes, and suffixes to determine meaning of words (APS – LA I.4). 3. Uses textual evidence to develop and support an interpretation of a scientific process or concept (APS – LA II.2).	1 – 3. See Strand I illustration; Strand II, the Genetics illustration and the Comparative Anatomy Illustration; and Strand III, the 2nd illustration and the illustration for performance standards # 8, 9.
	4. Develops increased competence in using the writing process to create a final product (APS – LA III.1). 5. Develops increased competence in using elements of effective writing (APS – LA III.2).	4 – 7. See Strand I illustration; Strand II, the 3rd illustration and the illustration for Environmental Studies; and Strand III, the illustration for performance standards # 8, 9.

GRADE 11-12	PERFORMANCE STANDARDS	ILLUSTRATIONS
	6. Supports an informed opinion (APS – LA III.6): • uses appropriate language, reasoning, and organizational structure for the audience and purpose, • provides relevant and convincing reasons, uses various types of evidence, and • demonstrates an awareness of possible questions, concerns, or counterarguments. 7. Responds to a variety of written, electronic, and other media (APS – LA III.7). 8. Develops increased competence with speaking and language conventions (APS – LA IV.3). 9. Demonstrates appropriate discussion in group discussions (APS – LA V.2). 10. Evaluates the information, explanations, or ideas of others (APS – LA V.5) 11. Evaluates information to develop informed opinions (APS – LA VI.1). 12. Develops increased competence in using research strategies (APS – LA VI.5).	8. See Strand I illustration; Strand II, 3rd illustration; and Strand III, 2nd illustration and the illustration for performance standards # 8, 9. 9, 10. See Strand II, 1st and 3rd illustrations and Strand III, 2nd illustration. 11, 12. See Strand I illustration; Strand II, 3rd illustration, the Environmental Studies illustration, and the illustrations for performance standards # 9 and #13; and Strand III, 1st illustration.