APS DISTRICT HIGH SCHOOL SCIENCE CURRICULUM FRAMEWORK

Course Title: Geology/Astronomy I **Course Number:** SEE BELOW

Department: Science **ADS Number:** SEE BELOW

Prerequisites: Successful completion of Algebra I or concurrent enrollment in Algebra I

Length of Course: One Year **Credit/PRI Area:** .50 per Sem/Science **Grade Level(s):** 9 - 12

COURSE AND ADS NUMBERS:

Geology/Astronomy I	43141	17014144
Geology/Astronomy I Bilingual	4314B	17018144
Geology/Astronomy I	060MW	17012144
Geology/Astronomy I	061MW	17012144
Geology/Astronomy I	062MW	17012144

Important Notes:

COURSE DESCRIPTION: This laboratory course* is designed to acquaint the student with the study of geology and astronomy and their related fields. The course emphasizes historical and physical geology. Topics may include paleontology, geologic time, plate tectonics, and map reading. Astronomy topics may include planetary geology and evolution of the stars and universe. The student examines scientific thinking and practices and how science impacts individuals, society, and New Mexico. Literacy strategies (e.g., reading, writing, speaking, research) 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 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 Geology/Astronomy 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
- *Understanding Earth* – Press, Frank and Siever, Raymond – Freeman – 1998 (2nd Edition)
- *Earth Science* – Spalding and Namowitz – McDougall Littell - 2003
- *Modern Physical Geology* – Thompson/Turk – Saunders College Publishing – 1991
- *Astronomy Today* – McMillan, Chaisson – Prentice Hall – 1999 or current edition
- *Laboratory Exercises in Astronomy* – Macmillan – 1976
- *Earth Science – Geology, the Environment, and the Universe* – Glencoe – 2002
- Telescopes
- Computers and computer software

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.
C. The student uses mathematical concepts, principles, and expressions to analyze data, develop models, understand patterns and relationships, evaluate findings, and draw conclusions.

GRADE 9 - 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).	**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 – 4, 6 – 16. 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 9 - 12	PERFORMANCE STANDARDS	ILLUSTRATIONS
	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. 5. Understands how scientific theories are used to explain and predict natural phenomena (e.g., plate tectonics, ocean currents, structure of atom) (NM - I.I.I.5). 6. 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. 7. Uses scientific reasoning and valid logic to recognize (NM - I.I.II.2): • faulty logic, • cause and effect, • the difference between observation and unsubstantiated inferences and conclusions, and • potential bias. 8. Understands how new data and observations can result in new scientific knowledge (NM - I.I.II.3; APS – MA IV.1E). 9. Critically analyzes an accepted explanation by reviewing current scientific knowledge (NM - I.I.II.4). 10. Examines investigations of current interest in science (e.g., superconductivity, molecular machines, age of the universe) (NM - I.I.II.5).	5. The student examines the theory of plate tectonics that Earth's crust and part of the mantle are broken into sections called plates, researches the locations of earthquakes and volcanic eruptions around the world, plots this data, predicts future tectonic events, and presents his/her findings with an explanation showing the relationship to plate boundaries. ✓ formation of hypothesis ✓ collection and representation of data ✓ thorough research ✓ accuracy ✓ clear communication ✓ effective presentation ✓ organization of data ✓ data supports theory ✓ critical thinking/insights ✓ defense of argument OR

GRADE 9 - 12	PERFORMANCE STANDARDS	ILLUSTRATIONS
	11. Examines the scientific processes and logic used in investigations of past events (e.g., using data from crime scenes, fossils), investigations that can be planned in advance but are only done once (e.g., expensive or time-consuming experiments such as medical clinical trials), and investigations of phenomena that can be repeated easily and frequently (NM - I.I.II.6). 12. Creates multiple displays of data to analyze and explain the relationships in scientific investigations (NM - I.I.III.1). 13. Uses mathematical models to describe, explain, and predict natural phenomena (NM - I.I.III.2; APS – MA I.16). 14. Uses technologies to quantify relationships in scientific hypotheses (e.g., calculators, computer spreadsheets and databases, graphing software, simulations, modeling) (NM - I.I.III.3). 15. Identifies and applies measurement techniques and considers possible effects of measurement errors (NM - I.I.III.4). 16. Uses mathematics to express and establish scientific relationships (e.g., scientific notation, vectors, dimensional analysis) (NM - I.I.III.5).	Taking a regionalistic approach, the student selects a volcano, researches it, and compiles all the information on butcher paper. He/She presents a write-up of his/her volcano to include historical background, geographic location (e.g., when and where it erupted), if it is active or dormant, and other pertinent information. In a class discussion the student presents findings and predicts future activity. ✓ individual participation ✓ active participation in discussions ✓ thorough research ✓ visual representation of information ✓ effective communication ✓ powerful presentation ✓ organization of information ✓ critical thinking/insights ✓ defense of argument

STRAND II: THE CONTENT OF SCIENCE-PHYSICAL SCIENCE
CONTENT STANDARD: The student understands the structure and properties of matter, the characteristics of energy, and the interactions between matter and energy.

BENCHMARKS: A. The student understands the transformation and transmission of energy and how energy and matter interact.
B. The student understands the motion of objects and waves, and the forces that cause them.

GRADE 9 - 12	PERFORMANCE STANDARDS	ILLUSTRATIONS
	1. Understands how heat can be transferred by conduction, convection, and radiation, and how heat conduction differs in conductors and insulators (NM - II.I.II.4).	1, 16. Using as a springboard the activities described in Strand I, the illustration for performance standard # 5, the student learns to read seismograms, determines where the earthquakes are, and how to use triangulation to locate and predict epicenters. This is done through an activity where the student uses a data table to determine the difference in arrival times between the primary and secondary waves for each earthquake listed. The student follows all of the outlined instructions of the activity to identify the epicenter for each earthquake. ✓ completion of all steps ✓ ability to follow directions ✓ accuracy OR The student labels a diagram illustrating all plate tectonic phenomena (e.g., plate boundaries, volcanoes, earthquakes). Extension: The student constructs models. ✓ accuracy ✓ realistic representations
	2. Understands that the ability of energy to do something useful (work) tends to decrease (and never increases) as energy is converted from one form to another.(NM - II.I.II.6).	2, 3, 8, 15. The student demonstrates the use of solar energy using photovoltaic cells to show transfer of energy from solar to mechanical. He/She uses a fuel cell and solar energy to split water (i.e., to produce hydrogen as fuel). An alternative would be to use solar cookers converting solar energy to heat. Extension: The student enters his/her car in a solar car race, collects data, and graphs it. OR

GRADE 9 - 12	PERFORMANCE STANDARDS	ILLUSTRATIONS
		The student learns how lenses and mirrors work in a telescope and draws a diagram to illustrate the difference between the two telescopes. Actual use of telescopes in lab activities includes examination of different kinds of lenses and their refractive and reflection properties.
	3. Understands that electromagnetic waves carry energy that can be transferred when they interact with matter (NM - II.I.II.7). 4. Understands the concept of equilibrium (i.e., thermal, mechanical, and chemical) (NM - II.I.II.11).	3, 4, 7, 9, 14. The student uses the H-R diagram (e.g., plot of the absolute magnitudes of stars against their spectral types) in an exercise that permits him/her to explore the relationships among the stars in the universe. The student discovers that there are many different kinds of stars of different brightnesses, surface temperatures, and sizes and that these properties are not immediately apparent to the casual observer. After completion of the exercise, the student writes a summary of what he/she learned. ✓ completion of exercise ✓ accurate plotting ✓ synthesis ✓ effective communication OR The student performs a spectral analysis lab. He/She looks at two different stars with given wave lengths and uses a chart to determine what the star is made of (e.g., 397nm is hydrogen). After obtaining the different readings and comparing his/her responses with other students' readings in the class, he/she writes an explanation of his/her findings and conjectures as to what elements are present in stars and what the most common elements are. The student observes a variety of bright line spectra produced by heated elemental gases, draws a sequence of bright lines on a data chart, and uses that information to identify the elements by the bright lines spectrum. ✓ accurate readings ✓ comparisons ✓ analysis ✓ effective communication

GRADE 9 - 12	PERFORMANCE STANDARDS	ILLUSTRATIONS
	5. Knows that there are four fundamental forces in nature: gravitation, electromagnetism, weak nuclear force, and strong nuclear force (NM - II.I.III.1).	5. The student views a PBS movie entitled, *The Creation of the Universe.* The subject of the movie deals with strong and weak nuclear forces and the Big Bang Theory. In preparation for the viewing, the student generates questions he/she may have relating to the subject, and as he/she views the movie, takes notes on items that address his/her questions. After the movie the class has a discussion and determines which questions were answered and which are still unanswered. The student conducts research to find answers to unanswered questions and reports findings to the class. ✓ active participation in discussions ✓ listening skills ✓ note taking ✓ response to questions ✓ effective research ✓ clear communication ✓ comprehension of main ideas
	6. Knows that every object exerts gravitational force on every other object and how this force depends on the masses of the objects and the distance between them (NM - II.I.III.2). 7. Knows that materials containing equal amounts of positive and negative charges are electrically neutral, but that a small excess or deficit of negative charges produces significant electrical forces (NM - II.I.III.3). 8. Understands the relationship between force and pressure and how the pressure of a volume of gas depends on the temperature and the amount of gas (NM - II.I.III.4). 9. Explains how electric currents cause magnetism and how changing magnetic fields produce electricity (e.g., electric motors, generators) (NM - II.I.III.5). 10. Represents the magnitude and direction of forces by vector diagrams (NM - II.I.III.6). 11. Knows that when one object exerts a force on a second object, the second object exerts a force of equal magnitude and in the opposite direction on the first object (i.e., Newton's Third Law) (NM - II.I.III.7).	6, 10 – 13. The student completes a variety of lab activities that deal with planetary orbits: • an ellipse lab dealing with Kepler's Laws (e.g., draw and measure a variety of ellipses labeling the dimensions and calculating the periods), • math labs dealing with equivalence ratios (e.g., conversions dealing with dimensional analysis), • labs dealing with Newton's Laws of Motion and gravitation (e.g., a separate lab for each law and then a combining lab involving Newton's law of gravitation), • centripetal labs (e.g., spinning weights on a string through a tube), and • rocket labs (e.g., wind-up toys measuring elastic tension). The student follows standard lab procedures submitting lab write-ups which include his/her hypothesis, data, calculations, and conclusions. After completion of the labs, the student engages in different activities (e.g., models of planets, models to show planetary distances, compares and contrasts Newton's Laws with Einstein's laws of gravity) to demonstrate understanding of the main concepts. ✓ completion of all lab activities ✓ written lab reports ✓ clear communication ✓ required tasks

GRADE 9 - 12	PERFORMANCE STANDARDS	ILLUSTRATIONS
	12. Applies Newton's Laws to describe and analyze the behavior of moving objects, including (NM - II.I.III.8): • displacement, velocity, and acceleration of a moving object, • Newton's Second Law, $F = ma$ (e.g., momentum and its conservation, the motion of an object falling under gravity, the independence of a falling object's motion on mass), and • circular motion and centripetal force. 13. Describes relative motion using frames of reference (NM - II.I.III.9). 14. Describes wave propagation using amplitude, wavelength, frequency, and speed (NM - II.I.III.10). 15. Explains how the interactions of waves can result in interference, reflection, and refraction (NM - II.I.III.11). 16. Describes how waves are used for practical purposes (e.g., seismic data, acoustic effects, Doppler effect) (NM - II.I.III.12).	

STRAND III: THE CONTENT OF SCIENCE-EARTH AND SPACE
CONTENT STANDARD: The student understands the structure of Earth, the solar system, and the universe, the interconnections among them, and the processes and interactions of Earth's systems.

BENCHMARKS: A. The student examines the scientific theories of the origin, structure, contents, and evolution of the solar system and the universe, and their interconnections.
B. The student examines the scientific theories of the origin, structure, energy, and evolution of Earth, its atmosphere, and their interconnections.

GRADE 9 - 12	PERFORMANCE STANDARDS	ILLUSTRATIONS
	1. Understands the scale and contents of the universe, including (NM - II.III.I.1): • range of structures from atoms through astronomical objects to the universe, and • objects in the universe such as planets, stars, galaxies, and nebulae.	1. After viewing diagrams and photos, the student creates flow charts or models to show size and distance relationship of (e.g., Earth to sun, solar system to galaxy, galaxy to universe). He/She makes comparisons between everyday units and units used to measure distance and objects in the universe (e.g., miles and kilometers, meters and kilometers). The student determines the distance to the next closest star or galaxy and applies mathematical calculations (e.g., scientific notation, metric system, light years, conversion factors) to explain concepts. ✓ creativeness ✓ accuracy ✓ clear explanations ✓ real-world applications
	2. Predicts changes in the positions and appearances of objects in the sky (e.g., moon, sun) based on knowledge of current positions and patterns of movements (e.g., lunar cycles, seasons) (NM - II.III.I.2).	2. Through participation in a variety of labs (e.g., lunar phase lab, transit of Venus lab, constellation lab), the student learns about eclipses of the moon and sun, star positions, and seasons of the year. He/She makes comparisons (e.g., summer constellations vs. winter constellations) and explains why the constellations differ seasonally. ✓ active participation in all labs ✓ analysis ✓ predictions ✓ effective communication
	3. Understands how knowledge about the universe comes from evidence collected from advanced technology (e.g., telescopes, satellites, images, computer models) (NM - II.III.I.3).	3. The student uses technology (e.g., Internet) to access photos and images from satellites and shares findings with the class. Along with the photos, the student offers explanations and/or descriptions of the pictures. ✓ technological skills ✓ effective visuals ✓ clarity in explanations

GRADE 9 - 12	PERFORMANCE STANDARDS	ILLUSTRATIONS
	4. Describes the key observations that led to the acceptance of the Big Bang theory and that the age of the universe is over 10 billion years (NM - II.III.I.4).	4. In a whole class discussion the student uses the Hubble Constant or Doppler shift to describe the expansion of the universe. He/She employs multiple diagrams to enhance understanding. ✓ active participation in discussions ✓ effective visuals ✓ articulation of ideas
	5. Explains how objects in the universe emit different electromagnetic radiation and how this information is used (NM - II.III.I.5).	5. In either an oral or written format, the student explains stellar evolution. He/She uses information gathered from satellites/telescopes to locate and describe properties of different celestial objects (e.g., Black Hole, pulsars, quasars) that exist. ✓ inclusion of all required concepts ✓ effective communication
	6. Examines the role that New Mexico research facilities play in current space exploration (e.g., Very Large Array, Goddard Space Center) (NM - II.III.I.7).	6. If school resources permit, the student takes a field trip to the Very Large Array. Prior to the trip the student participates in a discussion and views slides of what he/she will see upon the visit. After the trip the student responds in a variety of ways (e.g., write a story, answer questions) to what he/she observed. If resources are limited, the student gains the same concepts by going to either the University of New Mexico's (UNM) observatory or the Career Enrichment Center's (CEC) observatory. ✓ appropriate behaviors ✓ active participation in discussions ✓ effective communication Option: Before the student takes the trip or in lieu of the trip, the student writes out one question he/she is curious about, researches the answer to it, and presents findings to the class. ✓ thorough research ✓ appropriate response to question ✓ effective presentation

GRADE 9 - 12	PERFORMANCE STANDARDS	ILLUSTRATIONS
	7. Explains plate tectonic theory and understands the evidence that supports it (NM - II.III.II.5).	7, 9, 10. The student researches information on plate tectonics (See Strand I, the illustration for performance standard #5 and Strand II, the 1st illustration.). The student accomplishes this through a variety of activities: • construction of concept maps, • precut continent maps with designated fossils specific to a time period and arranged according to fossil evidence and glacial striations, • explanation of the development of the plate tectonic theory from the original continental drift theory to the current plate tectonic model, • guest speakers (e.g., Natural History Museum) discuss the geological history of New Mexico, • discussion to answer the essential question "How was the Earth formed?"; • discussion on the formation of the solar system followed by construction of models that label the Earth's layers, • research the impact of earthquakes on society (e.g., building codes), • construction of an earthquake-resistant wall using basic materials and test its strength, • study of building materials used by 3rd world countries (e.g., India's use of bamboo in building) and relate this to New Mexico's use of adobes in building, • radioactive decay labs, • experiments in physical and chemical weathering, and • development of rock cycle diagrams. The student submits written summaries of each activity completed. ✓ active participation in discussions ✓ completion of required activities ✓ evidence of understanding ✓ effective communication
	8. Describes how stars are powered by nuclear fusion, how luminosity and temperature indicate their age, and how stellar processes create heavier and stable elements that are found throughout the universe (II.III.I.6).	8. See Strand II, Set # 3, 4, 7, 9, 14 - the illustration that uses the H-R diagram.
	9. Knows that Earth's systems are driven by internal (i.e., radioactive decay and gravitational energy) and external (i.e., the sun) sources of energy (NM - II.III.II.6). 10. Describes convection as the mechanism for moving heat energy from deep	

GRADE 9 - 12	PERFORMANCE STANDARDS	ILLUSTRATIONS
	within Earth to the surface and discuss how this process results in plate tectonics, including (NM - II.III.II.7): • geological manifestations (e.g., earthquakes, volcanoes, mountain building) that occur at plate boundaries, and • impact of plate motions on societies and the environment (e.g., earthquakes, volcanoes).	

STRAND IV: SCIENCE AND 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 9 - 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).	1. The student views a movie (e.g., *Jurassic Park, Star Wars*), and makes a list of what is science and what is science fiction. After the movie the student participates in a discussion and gives his/her views providing support for his/her ideas. ✓ observation skills ✓ accuracy ✓ support for position
	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).	2. The student through research, guest speakers, and text readings, understands that technology has expanded our knowledge of the universe beyond the optical range (e.g., all parts of the electromagnetic spectrum). ✓ understanding of technological advances
	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, and 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).	3, 4. Working alone or in a small group, the student dismantles a modern electrical appliance/device (e.g., CD player, radio, cell phone, TV) and proceeds to figure out where all the parts came from originally. The student or team compiles a list of parts with the origination of each part and presents findings to the class. If each group is doing the same thing, then the groups might compare findings. ✓ active participation ✓ thorough and accurate research ✓ teamwork/collaboration ✓ effective presentation OR The student discusses in either whole class or small groups the use of radioactive materials for medical purposes, its use as nuclear fuel for power plants, and the environmental consequences of its use.

GRADE 9 - 12	PERFORMANCE STANDARDS	ILLUSTRATIONS
		OR The student conducts research (e.g., Internet, library) on the first TV and how it worked (i.e., cathode ray tubes) and presents findings to the class in an oral or written format. An option would be to research the Scantron machine and determine how it works.
	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).	5. Through lectures, text readings, and discussion the student learns about genetic engineering, how it can be used to degrade toxic waste, and the biotechnology being used to clean up waste and environmental pollution (e.g., mining and coal wastes). This information is used to tie in and connect with the resources in New Mexico. ✓ comprehension of the main ideas ✓ connections ✓ citation of examples
	6. Analyzes the impact of digital technologies on the availability, creation, and dissemination of information (NM - III.I.I.6).	6. The student participates in a discussion citing examples of advances in technology over the past several decades. In the example given the student explains the advances made from the past to the present. Depending on the sequence of how content is presented, the student can use examples from previous study or experiments, namely, computers, TVs, telescopes, seismographs, Global Positioning Systems, lasers, nanotechnology, etc. ✓ relevant examples ✓ defense of rationale
	7. Describes how human activities have affected ozone in the upper atmosphere and how it affects health and the environment.	7. The student completes labs that deal with the greenhouse effect and mapping of ozone holes over Australia. He/She also participates in discussions citing specific examples (e.g., use of Freon, CFC, and refrigerants in the atmosphere). ✓ active participation in discussions ✓ relevant examples ✓ clear explanations
	8. Describes uses of radioactivity (e.g., nuclear power, nuclear medicine, radiometric dating) (NM - III.I.I.8).	8. See Strand III, the illustration for performance standards # 7, # 9, # 10.

GRADE 9 - 12	PERFORMANCE STANDARDS	ILLUSTRATIONS
	9. Describes how scientific knowledge helps decision makers with local, national, and global challenges [e.g., Waste Isolation Pilot Project (WIPP), mining, drought, population growth, alternative energy, climate change] (NM - III.I.I.9).	9. The student learns that the Earth's processes are critical to making good environmental and political decisions. Consequently, this is emphasized throughout the year through ample opportunities presented in the curriculum. ✓ applications ✓ personal connections
	10. 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).	10. See Strand I, the illustration on plate tectonics.
	11. 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).	11, 15 – 17. 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 item ✓ differing viewpoints
	12. Explains how societies can change ecosystems and how these changes can be reversible or irreversible (NM - III.I.I.12).	12. The student researches various third world societies and compares their living standards and technology (e.g., China is becoming industrialized, thus using more steel and oil.). The student presents findings to the class. ✓ thorough research ✓ relevant information ✓ effective presentation
	13. Describes how environmental, economic, and political interests impact resource management and use in New Mexico (NM - III.I.I.13).	13. The student selects a county of New Mexico (e.g., Bernalillo - gypsum) and researches to find out what is made or produced in each county, how much money it generates (e.g., economics), and its environmental impact. Each student presents his/her findings to the class (e.g., poster, written, PowerPoint). ✓ thorough research ✓ relevant information ✓ effective presentation
	14. Describes New Mexico's role in nuclear science (e.g., Manhattan Project, WIPP, national laboratories) (NM - III.I.I.14). 15. Identifies how science has produced knowledge that is relevant to individual health and material prosperity (NM - III.I.I.15).	14. If resources permit, the student takes a field trip to WIPP. He/She looks at the formation of halite (i.e., salt - a nonmetallic mineral resource) and discusses why or why not it is a good medium to use for nuclear waste. ✓ local connections ✓ clear communication

GRADE 9 - 12	PERFORMANCE STANDARDS	ILLUSTRATIONS
	16. 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). 17. 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). 18. 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). 19. 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).	18, 19. Integrated consistently in the curriculum throughout the year is the career connection. Current textbooks interject the "real-life" aspect and applications in almost every chapter, and the instructor takes every opportunity to insert that in, whether it be through personal experiences or through questioning (e.g., What does an astrophysicist do? What is an environmental geologist?). The student talks about his personal career interest and explains where science is used in this career (e.g., museum curator, chemical engineer, planetarium director). OR Either as a school-wide project or class project, the student participates in a Career Day Fair. The student listens to a variety of speakers (e.g., astronomer, museum curator, geologist) in the science fields talk about aspects of their jobs. After the fair the student either orally or in written format summarizes one career field that held special interest to him/her highlighting the science connection. Options: The student helps in the organization of the event by suggesting and contacting some of the guest speakers. Some of these speakers could be personal connections that he/she has (e.g., parents, former students). ✓ individual participation ✓ listening skills ✓ personal connections ✓ scientific significance to career fields ✓ effective presentation

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

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

GRADE 9 - 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; listening to other's 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 area: (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.	1 – 3. See Strand I, 2nd illustration; Strand IV, the illustration for performance standard # 5; and Strand IV, the illustration for performance standards # 11, 15 –17.
	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).	
	4. Develops increased competence in using the writing process to create a final product (APS – LA III.1).	4 – 7. See Strand II, the illustration for performance standards # 3, 4, 7, 9, 14; Strand II, the illustration for performance standards # 6, 10 – 13; and Strand III, the illustrations for performance standards # 5 and # 6.
	5. Develops increased competence in using elements of effective writing (APS – LA III.2).	

GRADE 9 - 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. Listens to and analyzes a presentation or discussion (APS – LA V.1). 10. Conducts research and collects data from in-depth field studies (APS – LA VI.1). 11. Obtains and sends information electronically to support advanced research (APS – LA VI.2). 12. Uses a variety of technology (APS – LA VI.5). 13. Recognizes and continues to use the elements of formal citations to document sources (APS – LA VI.6). 14. Accesses appropriate style manuals as research guides (APS – LA VI.7). 15. Synthesizes information from multiple research studies to draw conclusions and inferences that go beyond those found in any of the individual studies (APS – LA VI.9). 16. Synthesizes and organizes information from a variety of sources to inform and persuade an audience (APS – LA VI.9).	8. See Strand I, 2nd illustration; Strand III, the illustration for performance standard # 5; and Strand IV, the illustration for performance standards # 3, 4, # 6, and # 11, 15 – 17. 9. See Strand II, the illustration for performance standard # 5; Strand III, 1st illustration; and Strand IV, 1st illustration and the illustration for performance standards # 18, 19. 10 – 16. See Strand I, 1st illustration; Strand III, 3rd illustration and illustration for performance standards # 7, 9, 10; and Strand IV, the illustration for performance standards # 3,4, and #12.