APS DISTRICT HIGH SCHOOL SCIENCE CURRICULUM FRAMEWORK

Course Title: Geology **Course Number:** SEE BELOW

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

Prerequisites:

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

COURSE AND ADS NUMBERS:

Geology	42141	17024144
Geology-Bilingual	4214B	17028144
Geology	060MH	17022144
Geology	061MH	17022144
Geology	062MH	17022144

Important Notes: ***It is strongly recommended that the student successfully completes Algebra I or be concurrently enrolled in Algebra I.***

COURSE DESCRIPTION: This laboratory course* is designed to acquaint the student with the study of geology and its related fields. Topics of study may include, but not be limited to, historical geology (e.g., geologic time, life through time, the Earth's origins and the oldest rocks), physical geology (e.g., plate tectonics, minerals, rock cycles, volcanology, seismology, natural resources), geology of New Mexico, map reading, and career opportunities. The student examines scientific thinking and practices and how science impacts individuals and society. 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 refer to and align with the State of New Mexico Science Standards (NM), the State of New Mexico Social Studies Standards (NM - S), 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 teachers in the Albuquerque Public Schools (APS).

ASSESSMENTS:
Assessments may include 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
- *Earth Science – Geology, the Environment, and the Universe* – Glencoe – 2002
- *The Earth Through Time* – Levin, Harold – Harcourt Brace Jovanovich College Publishers – 1992
- *The Dynamic Earth* – Skinner, Brian and Porter, Stephen – Wiley & Sons, Inc. – 1992
- *Physical Geology – Laboratory Text and Manual* – Dallmeyer, R. D. – Kendall/Hunt Publishing Company - 1987
- Microscopes
- 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; NMS – ID.8).	**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 Note: For all labs done in this document by the student, he/she 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 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
	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; NMS – IID.1).	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
	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.	OR
	8. Understands how new data and observations can result in new scientific knowledge (NM – I.I.II.3).	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
	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).	

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; APS – MA IV). 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).	√ organization of information √ critical thinking/insights √ defense of argument

STRAND II: THE CONTENT OF 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 properties, underlying structure, and reactions of matter.
B. The student understands the transformation and transmission of energy and how energy and matter interact.

GRADE 9 - 12	PERFORMANCE STANDARDS	ILLUSTRATIONS
	1. Classifies matter in a variety of ways (e.g., element, compound, mixture, solid, liquid, gas, acidic, basic, neutral) (NM – II.I.I.1).	1, 10. The student conducts a survey of a variety of geologic resources (e.g., minerals, rocks, other natural resources), classifies the objects as to whether they are element, compound, or mixture, and, if it is a solid, liquid, or gas, tests it to see if it is acidic, basic, or neutral. √ accurate classification of object
	2. Identifies, measures, and uses a variety of physical and chemical properties (e.g., electrical conductivity, density, viscosity, chemical reactivity, pH, melting point) (NM – II.I.I.2).	2. The student participates in a variety of labs: • density lab which involves different materials, • viscosity lab related to flows of lava, • water labs to test pH, and • investigates Bowen's reaction series. √ adherence to lab procedures √ comprehension of main concepts √ individual participation √ effective communication
	3. Knows how to use properties to separate mixtures into pure substances (e.g., distillation, chromatography, solubility) (NM – II.I.I.3).	3. The student works with soils separating the mixtures into substances and identifies the solubility of the different components of the soils. √ accurate classifications √ accurate measurements √ predictions (e.g., what the soil is made of)
	4. Describes trends in properties (e.g., ionization energy or reactivity as a function of location on the periodic table, boiling point of organic liquids as a function of molecular weight) (NM – II.I.I.4). 5. Understands that matter is made of atoms and that atoms are made of subatomic particles (NM – II.I.I.5).	4 – 9. The student is introduced to the periodic table to examine the atomic structure of elements. After the introduction, the student completes labs on crystal and minerals to examine their atomic structures. √ understanding of how the periodic table works √ completion of lab activities √ adherence to lab procedures

GRADE 9 - 12	PERFORMANCE STANDARDS	ILLUSTRATIONS
	6. Understands atomic structure, including (NM – II.I.I.6): • most space occupied by electrons, • nucleus made of protons and neutrons, • isotopes of an element, • masses of proton and neutron 2000 times greater than mass of electron, and • atom held together by proton-electron electrical forces. 7. Explains how electrons determine the properties of substances by (NM – II.I.I.7): • interactions between atoms through transferring or sharing valence electrons, • ionic and covalent bonds, and • the ability of carbon to form a diverse array of organic structures. 8. Makes predictions about elements using the periodic table (e.g., number of valence electrons, metallic character, reactivity, conductivity, type of bond between elements) (NM – II.I.I.8). 9. Understands how the type and arrangement of atoms and their bonds determine macroscopic properties (e.g., boiling point, electrical conductivity, hardness of minerals) (NM – II.I.I.9). 10. Knows that states of matter (i.e., solid, liquid, gas) depend on the arrangement of atoms and molecules and on their freedom of motion (NM – II.I.I.10). 11. Knows that some atomic nuclei can change, including (NM – II.I.I.11): • spontaneous decay, • half-life of isotopes, • fission, • fusion (e.g., the sun), and • alpha, beta, and gamma radiation.	11, 16, 21, 23. The student completes a radioactive decay lab related to geologic time. After completion of the lab, he/she constructs models using kits and performing half-life, graphing, and other math calculations (e.g., uranium, carbon-14, potassium 40) required in the construction of the model. √ accurate calculations √ model structure and composition √ adherence to lab procedures √ data collection

GRADE 9 - 12	PERFORMANCE STANDARDS	ILLUSTRATIONS
	12. Knows that chemical reactions involve the rearrangement of atoms and that they occur on many timescales (e.g., picoseconds to millennia) (NM – II.I.I.12). 13. Understands types of chemical reactions (e.g., synthesis, decomposition, combustioredox, neutralization) and identifies them as exothermic or endothermic (NM – II.I.I.13). 14. Knows how to express chemical reactions with balanced equations that show (NM – II.I.I.14): • conservation of mass, and • products of common reactions. 15. Describes how the rate of chemical reactions depends on many factors that include temperature, concentration, and the presence of catalysts (NM – II.I.I.15). 16. Identifies different forms of energy, including kinetic, gravitational (potential), chemical, thermal, nuclear, and electromagnetic (NM – II.I.II.1). 17. Explains how thermal energy (heat) consists of the random motion and vibrations of atoms and molecules and is measured by temperature (NM – II.I.II.2). 18. Understands that energy can change from one form to another (e.g., changes in kinetic and potential energy in a gravitational field, heats of reaction, hydroelectric dams) and knows that energy is conserved in these changes (NM – II.I.II.3). 19. Explains how heat flows in terms of the transfer of vibrational motion of atoms and molecules from hotter to colder regions (NM – II.I.II.5).	12 – 15. The student recognizes the distinctive landforms produced by ground water and understands how landscapes are formed by solution activity. He/She studies stereoscopic images of various Karst areas worldwide and constructs a series of diagrams illustrating the sequence of stages in the evolution of Karst topography from the early stage with a few small, scattered sinkholes to the late stage where solution activity has reduced area to the base of the limestone unit with a few widely scattered erosional remnants (e.g., rounded hills, knolls). The student presents the equations that represent the formation of limestone and the decomposition. √ sequencing √ landform analysis √ realistic representations √ effective use of stereoscopic lab techniques √ accuracy in equations 16 – 19. See Strand I, the illustration for performance standard # 5.

GRADE 9 - 12	PERFORMANCE STANDARDS	ILLUSTRATIONS
	20. Describes the characteristics of electromagnetic waves (e.g., visible light, radio, microwave, X-ray, ultraviolet, gamma) and other waves (e.g., sound, seismic waves, water waves), including (NM – II.I.II.8): • origin and potential hazards of various forms of electromagnetic radiation, and • energy of electromagnetic waves carried in discrete energy packets (photons) whose energy is inversely proportional to wavelength. 21. Knows that each kind of atom or molecule can gain or lose energy only in discrete amounts (NM – II.I.II.9). 22. Explains how wavelengths of electromagnetic radiation can be used to identify atoms, molecules, and the composition of stars (NM – II.I.II.10). 23. Understands the concept of equilibrium (i.e., thermal, mechanical, and chemical) (NM – II.I.II.11).	20, 22. The student incorporates geologic maps, topographic maps, and Global Positioning Systems (GPS) to do the following: • examines electromagnetic spectrum and transverse waves, • looks at past, present, and future earthquake activity, • reads and analyze seismograms, • calculates distances and magnitudes, • tracks current earthquakes and patterns with the aid of computers, • compares building codes in New Mexico with high earthquake probability areas, and • visits the USGS seismic lab. The student submits written summaries of activities using standard lab reporting procedures. √ active participation √ data collection √ math analyses √ interpolations and extrapolations √ map reading √ application of appropriate lab procedures √ effective communication √ documentation of work

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 and 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. 2. Describes the characteristics of the evolution of Earth in terms of the geosphere, the hydrosphere, the atmosphere, and the biosphere (NM – II.III.II.1; NMS – IID.4).	1. The student uses photos of volcanoes and other structures on Mars and Earth and makes comparisons of the geology of the two planets (e.g., water erosion, composition). √ analysis 2. The student recognizes the types of landforms developed by alpine and continental glaciers and understands the processes responsible for their development. He/She studies a topographic map of Scott Glacier in Cordova, Alaska and labels landforms (e.g., outwash plain, aretes, recessional moraines, medial moraines, hanging valleys, horns, braided streams, cirques, ice falls). He/She compares topographic profiles of river valleys and glacial alleys. The student draws diagrams illustrating the major landforms developed by continental glaciation and the processes by which they are produced and views glacial landforms stereoscopically. √ cause and effect √ use of technology √ landform analysis √ correct use of stereoscopes √ realistic representations

GRADE 9 - 12	PERFORMANCE STANDARDS	ILLUSTRATIONS
	3. Recognizes that radiometric data indicate that Earth is at least 4 billion years old and that Earth has changed during that period (NM – II.III.II.2).	3. The student, working alone or with a partner, selects one of the following topics: dinosaurs, mammals, insects, plants or marine organisms specific to New Mexico, including locations, rock types, and geologic time. All of these topics can extend to include a more global picture (i.e., past, present, future theories related to the topic). His/Her project entails in-class labs, on and off campus field work, and independent student work completed related to the topic. The study may vary (e.g., photos or examples of rock types put together in a geologic time sequence). Each student initiates contact with a professional (e.g., interviews, actual field work with the professional) in this area (e.g., someone from USGS, Natural History Museum, university). The student, individually or with a partner, presents work to the class. √ active participation √ data collection √ thorough field work √ organization √ clear communication √ chronology √ teamwork/collaboration √ effective presentation OR The student charts geologic time with New Mexico events including plants and animals starting with the oldest rocks found here, makes a calendar to express geologic time in human terms, and writes a metaphor (e.g., life span, distance) to make connections.

GRADE 9 - 12	PERFORMANCE STANDARDS	ILLUSTRATIONS
	4. Describes the internal structure of Earth (e.g., core, mantle, crust) and the structure of Earth's plates (NM – II.III.II.3). 5. Understands the changes in Earth's past and the investigative methods used to determine geologic time, including (NM – II.III.II.4; NMS – IA.5, ID.2): • rock sequences, relative dating, fossil correlation, and radiometric dating, and • geologic time scales, historic changes in life forms, and the evidence for absolute ages (e.g., radiometric methods, tree rings, paleomagnetism).	4, 5. The student chooses a site for a specific natural resource for in-depth study from the beginning of the exploration of the area, the actual extraction, and the reclamation that takes place after the resources are gone. This study may include the cultural history of the area (e.g., San Pedro Gold Mine). The student engages in a variety of activities that range from visiting the site, taking field notes, collecting data, studying the geologic history and formation of the area and different parts of the rock cycle to working with a specialist connected to the resource and collecting ore samples. √ active participation in all activities √ synthesis of information √ sequencing √ predictions √ all required components OR The student chooses a specific resource (e.g., copper) and researches all the New Mexico areas in which this resource is located and presents findings to the class. The student presents specific information on the economics, environmental connections, chemistry, and uses of the resource. √ thoroughness of research √ relevant information √ effective presentation OR The student analyzes resources used in his/her lifetime. He/She takes a specific material item important to him/her and gives the history of that item with a specific example (e.g., car, house CD player). The student breaks that item down until he/she gets to the resources that make it up, itemizes the resources, and lists from where the resources might come, starting here in New Mexico and broadening to other areas globally. The student also includes the chemistry of the ores, resources, and final products. √ identification of resources √ analysis √ accuracy √ thoroughness

GRADE 9 - 12	PERFORMANCE STANDARDS	ILLUSTRATIONS
	6. Explains plate tectonics theory and understands the evidence that supports it (NM- II.III.II.5). 7. 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). 8. Describes convection as the mechanism for moving heat energy from deep within Earth to the surface and discusses 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). 9. Describes the patterns and relationships in the circulation of air and water driven by the sun's radiant energy, including (NM – II.III.II.8): • patterns in weather systems related to the transfer of energy, • differences between climate and weather, • global climate, global warming, and the greenhouse effect, and • El Niño, La Niña, and other climatic trends.	6 – 8. The student recognizes and classifies major features resulting from volcanic activity and explains how and where these features are produced by the Earth's tectonic system. He/She collects data and evaluates information provided by topographic maps, aerial photographs, remote sensing images, and stereoscopic images. The student chooses a particular volcanic feature and produces a multimedia presentation. √ thorough research √ use of technology √ data collection √ organization √ landform analysis √ effective presentation OR The student constructs a series of diagrams illustrating the evolution of topography associated with volcanic activity (e.g., from the initial constructional features to the isolated remnants of volcanic necks, dikes, and lava-capped buttes). (Resource: *Exercises in Physical Geology)* √ cause and effect √ organization of data √ visual presentation of information See also Strand I, the illustration for performance standard # 5. 9, 12. The student researches the effect of global warming on glaciers worldwide. He/She determines the climate-induced changes within the glaciers themselves and the environmental impact locally to the glaciers as well as worldwide implications. The student extrapolates into the near future and attempts to predict environmental impact of continued glacial melt. He/She presents findings (e.g., research paper, oral presentation, poster). (Resource: *Exercises in Physical Geology)* √ cause and effect √ thoroughness of research √ relevance √ effective presentation √ analysis and synthesis of information √ predictions

GRADE 9 - 12	PERFORMANCE STANDARDS	ILLUSTRATIONS
	10. Knows that Earth's system contains a fixed amount of natural resources that cycle among land, water, the atmosphere, and living things (e.g., carbon and nitrogen cycles, rock cycle, water cycle, ground water, aquifers) (NM – II.III.II.9).	10. See Strand II, the Illustration for performance standards # 12 – 15.
	11. Describes the composition and structure of Earth's materials, including (NM – II.III.II.10; NMS – IB.2, IIB.1, IIB.3): • the major rock types (i.e., sedimentary, igneous, metamorphic) and their formation, and • natural resources (e.g., minerals, petroleum) and their formation.	11. The student completes labs of igneous, sedimentary, and metamorphic rocks. After completion of the labs, the student collects rock samples and identifies the types, group, and mineralogy of the rocks. √ adherence to lab procedures √ accurate identification and classification of rocks
	12. Explains how the layers of the atmosphere (e.g., ozone, ionosphere) change naturally and artificially (NM II.III.II.11).	
	13. Explains how the availability of ground water through aquifers can fluctuate based on multiple factors (i.e., rate of use, rate of replenishment, surface changes, and changes in temperature) (NM – II.III.II.12; NMS – IA.2, IID.3).	13. The student contours a water table using the surface elevations of lakes within an area. He/She determines the general direction of groundwater movement, how deep to drill a well to obtain water at a given site, and which direction waste contaminants would move from a designated dumpsite. √ effective use of contour mapping techniques √ predictions √ slope analysis

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*), 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 crystal structure, telescopes and understanding of the universe) (NM – III.I.I.2).	2, 5. 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., seismometers). √ 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; NMS – IA.4, IC.9).	3, 4. The student discusses in either whole class or small groups the use of radioactive materials (e.g., uranium) for medical purposes, its use as nuclear fuel for power plants, and the environmental consequences of its use. √ individual participation in discussions √ understanding of technological influences
	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. Analyzes the impact of digital technologies on the availability, creation, and dissemination of information NM – III.I.I.6).	

GRADE 9 - 12	PERFORMANCE STANDARDS	ILLUSTRATIONS
	6. Describes how human activities have affected ozone in the upper atmosphere and how it affects health and the environment (NM – III.I.I.8).	6, 8, 10, 11, 14 – 17. The student examines current news items (e.g., articles, TV, newspapers) on mining issues (e.g., pollution, reclamation). 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
	7. Describes uses of radioactivity (e.g., nuclear power, nuclear medicine, radiometric dating) (NM – III.I.I.8).	7. See Strand II, the Illustration for performance standards # 11, 16, 21, 23.
	8. 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; NMS – IA.4).	
	9. 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; NMS – ID.7).	9. See Strand I, the Illustration for performance standard # 5.
	10. Evaluates and selects appropriate geographic representations to analyze and explain natural and man-made issues and problems (NMS – IIA.1).	
	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).	
	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 3rd 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

GRADE 9 - 12	PERFORMANCE STANDARDS	ILLUSTRATIONS
	13. Describes how environmental, economic, and political interests impact resource management and use in New Mexico (NM – III.I.I.13). 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). 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).	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 product, PowerPoint). √ thorough research √ relevant information √ effective presentation 18, 19. The student listens to a variety of speakers (e.g., hydrologist, paleontologist, exploration geologist, seismologist) talk about aspects of their jobs. After the presentation the student either in oral or written format, summarizes one career field that held special interest to him/her highlighting the geologic connection and presents it to the class. √ individual participation √ listening skills √ personal connections √ scientific significance to career fields √ clarity in communication √ effective presentation

STRAND V: LITERACY
CONTENT STANDARD: The student communicates geological principles through critical thinking and literacy strategies.

BENCHMARK: The student demonstrates proficiency in problem solving, reading comprehension, specialized vocabulary, and a variety of writing, speaking, and research activities.

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 areas: (APS – LA 9 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 9 I.4). 3. Asks critical questions prompted by texts and researches answers for a broader understanding (APS – LA 10 I.1). 4. Compares and contrasts effectiveness of deductive and inductive reasoning in a variety of texts (APS – LA 11 I.8). 5. Uses textual evidence to develop and support an interpretation of a scientific process or concept (APS – LA 9 II.2).	1 – 6. See Strand I, the last illustration; Strand III, the 3rd illustration and the illustration for performance standards # 4. 5. and # 9, 12; and Strand IV, the illustration for performance standards # 6, 8, 10, 11, 14 – 17.

GRADE 9 - 12	PERFORMANCE STANDARDS	ILLUSTRATIONS
	6. Critically interprets and evaluates experiences and ideas (e.g., reflects on observations and their relationship to a current viewpoint, distinguishes fact from fiction) (APS – LA 10 II.6).	
	7. Develops increased competence in using the writing process to create a final product (APS – LA 9 III.1).	7 – 10. See Strand I, the 1st illustration; Strand II, the 2nd illustration and the illustration for performance standards # 20, 22; and Strand III, the illustration for performance standards # 9, 12.
	8. Develops increased competence in using elements of effective writing (APS – LA 9 III.2).	
	9. Supports an informed opinion: (APS – LA 9 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.	
	10. Responds to a variety of written, electronic, and other media (APS – LA 9 III.7).	
	11. Develops increased competence with speaking and language conventions (APS – LA 9 IV.3).	11. See Strand I, the 1st and 2nd illustrations; Strand III, the 3rd illustration; and Strand III, the illustration for performance standards # 9, 12.
	12. Understands how to use the skills of historical analysis to apply to current scientific issues (NMS – ID.1).	12. See Strand IV, Science and Society.
	13. Analyzes an instance of public speaking or media presentations (APS – LA 10 V.1).	13. See Strand III, the 3rd illustration; Strand IV, the 1st and 2nd illustrations; and Strand IV, the last illustration.
	14. Uses systematic strategies to organize and record information (APS – LA 10 VI.1).	14 – 17. See Strand I, the 1st illustration; Strand III, the 3rd illustration and the illustrations for performance standards # 4, 5 and #9, 12; and Strand IV, the illustrations for performance standards # 12 and # 13.
	15. Uses a variety of information resources to critically interpret and evaluate experiences, language, and ideas (APS – LA 10 VI.2).	
	16. Analyzes controversial issues (APS – LA 10 VI.6).	
	17. Defends positions on research issues (APS – LA 10 VI.7).	