APS DISTRICT HIGH SCHOOL SCIENCE CURRICULUM FRAMEWORK

Course Title: Geology/Astronomy II **Course Number:** 44114

Department: Science **ADS Number:** 17014944

Prerequisites: Successful completion of Geology/ Astronomy I

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

COURSE AND ADS NUMBERS:
Geology/Astronomy II 44114 17014944
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 Geology/Astronomy I. The student who selects this course has already met science standards. Topics covered include at least one from geology and one from astronomy. Geology topics may include mineral resources, rock cycle, volcanology, seismology, paleontology, glaciology, and geomorphology with an emphasis on field methods. Astronomy topics may include the planetary systems, stellar evolution, galaxies, and cosmology. Additional topics in both areas are left to teacher 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 examples 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
- *Exercises in Physical Geology* – Hamblin and Howard – MacMillan Publishing Co. – 1989
- *Activities in Astronomy* – Hoff/Kelsey/Neff – Kendall Hunt Publishing Company - 1984
- 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.

GRADE 11-12	PERFORMANCE STANDARDS	ILLUSTRATIONS
		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. Describes the essential components of an investigation, including appropriate methodologies, proper equipment, and safety precautions (NM – I.I.I.1).	1 – 8. 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.
	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).	3, 4. The student researches Carlsbad Caverns. If resources permit, he/she takes a field trip to Carlsbad to see the caverns first hand or goes to the New Mexico Museum of Natural History to view a model of a cavern or conducts a web search of the caverns. The student gives a poster board presentation to the class. (Resource: *Exercises in Physical Geology)* ✓ extensive research ✓ organization ✓ technology skills ✓ identification of features ✓ identification and understanding of processes ✓ effective presentation
	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. See also Strand II, the Karst Topography topic, the illustration for

GRADE 11-12	PERFORMANCE STANDARDS	ILLUSTRATIONS
	5. Understands how scientific theories are used to explain and predict natural phenomena (e.g., plate tectonics, ocean currents, structure of atoms) (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. Understands how new data and observations can result in new scientific knowledge (NM – I.I.II.3; APS – MA IV.1E). 8. Critically analyzes an accepted explanation by reviewing current scientific knowledge (NM – I.I.II.4). 9. Uses mathematical models to describe, explain, and predict natural phenomena (NM – I.I.III.2; APS – MA I.16).	performance standards #16,17. 9. See Strand II, the illustration for performance standard # 18.

STRAND II: CONTENT OF SCIENCE – EARTH AND SPACE SCIENCE
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 11-12	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. 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). 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). 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). 5. Explains how objects in the universe emit different electromagnetic radiation and how this information is used (NM - II.III.I.5). 6. 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 (NM - II.III.I.6). 7. Examines the role that New Mexico research facilities play in current space	The study of Geology/Astronomy II is topical. Before the student can do most of the suggested activities in this strand, he/she builds on his/her prior knowledge through presentation of lecture, current literature, web search, text, video, and lab activities. **STELLAR EVOLUTION** 1 – 3, 5 – 7. Using Hertzsprung – Russel (H-R) diagrams, the student tracks the life cycle of a star [e.g., stellar birth, mid-life (main sequence), stellar death]. This includes a time frame for each stage. The student participates in all or some of the following activities: • researches current data on black holes, Cygnus x-1, and builds a model in groups, • researches and presents current theories on any of the following: neutron stars, pulsars, quasars, white dwarfs, or other remnants of stellar explosions – research includes examples and locations of these objects, • researches supernovae and formation of heavy elements, • explains how a protostar's luminosity changes by applying the radius-luminosity-temperature relation, • looks at an area like the Trifid Nebula, M20 using a telescope – After locating, the student answers questions related to this area (e.g., Why are parts dark? Why are parts bright?), • finds Betelgeuse in the constellation Orion using an 8" to 10" telescope, researches information related to this star, and answers questions (e.g., Why is it variable? What is the time period? How old is it and in what stage is it? Could the star supernova?). The student uses research information to compare its volume to our solar system and the sun and states possible ramifications for life on Earth when the star supernovas, • finds M 1 or the Crab Nebula with the 8" or 10" telescope, makes a star chart to show its position in the sky and where it is located in

GRADE 11-12	PERFORMANCE STANDARDS	ILLUSTRATIONS
	exploration (e.g., Very Large Array, Goddard Space Center) (NM - II.III.I.7).	relationship to constellations, and researches its history including who and when it was discovered, and/or • demonstrates the densities of various astronomical objects, an interstellar cloud, a star, a terrestrial planet, a white dwarf, and a neutron star. The student selects a common object (e.g., apple) and for the lowest densities, calculates how large a volume would contain the object's equivalent mass and for the high densities, calculates how many of the objects would have to fit into a standard volume (e.g., 1 cm^3). ✓ mathematical calculations ✓ extensive research ✓ relevant information ✓ technology skills ✓ response to questions ✓ accurate diagrams ✓ effective communication ✓ active participation in activities **GALAXIES** 1, 5, 6. The student studies the H-R diagrams of several open galactic clusters to determine their ages and distances and to detect the effect of interstellar reddening on cluster observations. ✓ questioning ✓ interpretation of data ✓ formulation of models ✓ inference ✓ logic ✓ predictions 3. The student develops a system for classifying galaxies, compares the numbers of different types of galaxies in the Virgo cluster, and determines the linear sizes of some of the cluster members. He/She collects data for this activity by examining photographs of galaxies in the Virgo cluster. He/She considers galactic properties (e.g., overall shape, prominence of the central bulge relative to the disc, possible arm structure). The student determines the relative numbers of different types of galaxies as well as distance to the cluster and size of the galaxies in the cluster. (Resource: *Activities in Astronomy)*

GRADE 11-12	PERFORMANCE STANDARDS	ILLUSTRATIONS
		✓ classification techniques ✓ mathematical analyses ✓ predictions **COSMOLOGY** 1, 3, 4. The student collects data and investigates the cosmological principle and explains its significance to describe the cosmic microwave background radiation, and its importance. He/She discovers the approximate age of the universe, summarizes the leading evolutionary models of the universe, and explores factors pertaining to expansion theory and the relationship between the future of the universe and the overall geometry of space. The student, working alone or in a group, selects one of the above topics and prepares an oral or multimedia presentation. ✓ thorough research ✓ relevant information ✓ mathematical analysis ✓ effective communication ✓ teamwork/collaboration ✓ active participation in activities ✓ effective presentation 7. The student investigates New Mexico's astronomical research facilities. He/She participates in a field trip to a facility (e.g., Kirtland/Sandia Labs, Planetarium, Very Large Array, Goddard Space Center) for a firsthand look, or conducts a web search of one of these facilities. The student gives a visual presentation (e.g., poster board) to the class. ✓ extensive research ✓ effective presentation ✓ organization ✓ mastery of vocabulary **PLANETARY SYSTEMS** 2, 3, 7. The student researches a specific object in the solar system and makes a presentation to the class to include all data and current findings. Along with photos and data charts, the student creates an activity or lab that all students complete to help in their understanding of the object (e.g., applications of Kepler's laws, measurements and calculations, small scaled models of the object).

GRADE 11-12	PERFORMANCE STANDARDS	ILLUSTRATIONS
		✓ extensive research ✓ effective presentation ✓ applications ✓ individual participation Options: a) The student researches additional planetary system information (e.g., field trip to Natural History Museum, guest lecture by an expert in the field, visit to the Very Large Array). b) The student compares and contrasts (e.g., video, book) science fact versus science fiction in space travel (e.g., exploration of Mars). He/She gives all data (e.g., time, vehicles, fuels, living conditions). c) The student makes observations through a semester from one location (e.g., home, school). He/She charts the movement of the sun, moon, and planets from this location. Once the student understands where the ecliptic is, he/she locates the North Star. Through this and other modeling, the student understands the movement of the planets. **GLACIOLOGY** 8. 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
	8. Describes the characteristics and the evolution of Earth in terms of the geosphere, the hydrosphere, the atmosphere, and the biosphere (NM – II.III.II.1).	**PALEONTOLOGY** 8, 9, 11, 17. 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

GRADE 11-12	PERFORMANCE STANDARDS	ILLUSTRATIONS
	9. 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).	project entails in-class labs, on and off campus field work, and independent student work 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 partner, presents the 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.
	10. Describes the internal structure of Earth (e.g., core, mantle, crust) and the structure of earth's plates (NM – II.III.II.3). 11. Understands the changes in Earth's past and the investigative methods used to determine geologic time, including (NM – II.III.II.4): • 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).	**MINERAL RESOURCES** 10, 11, 13, 14, 16, 17. 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 and ore samples, studying the geologic history and formation of the area and different parts of the rock cycle to working with a resource specialist. ✓ active participation in all activities ✓ synthesis of information ✓ sequencing ✓ predictions ✓ all required components

GRADE 11-12	PERFORMANCE STANDARDS	ILLUSTRATIONS
		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 **SEISMOLOGY** 10, 12 – 14. The student incorporates geologic maps, topographic maps, and Global Positioning Systems (GPS) to do the following: • look at past, present, and future earthquake activity, • read and analyze seismograms, • calculate distances and magnitudes, • track current earthquakes and patterns with the aid of computers, • compares building codes in New Mexico with high earthquake probability areas, and • visit the USGS seismic lab.

GRADE 11-12	PERFORMANCE STANDARDS	ILLUSTRATIONS
		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 OR The student observes environmental changes (e.g., earthquake, nuclear waste going through Albuquerque on the way to the WIPP site) that take place during the time he/she is in this class. Working in small groups, the student prepares one news release per month for the local media in response to a natural disaster. He/She finds in the local newspapers and news broadcasts issues related to geology and writes responses from a geologist's perspective. Since the writings are for a nontechnical audience, the write-up is brief (e.g., one page), includes the topic, nature and significance of the event or issue, and emphasizes its implications for the public. The title must be an "attention grabber." ✓ all required components ✓ teamwork/collaboration ✓ individual participation ✓ extensive research ✓ elements of effective writing ✓ audience response
	12. Explains plate tectonic theory and understands the evidence that supports it (NM – II.III.II.5).	**VOLCANOLOGY** 12, 14. 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

GRADE 11-12	PERFORMANCE STANDARDS	ILLUSTRATIONS
		✓ landform analysis ✓ effective presentation
	13. 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).	13. 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
	14. 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).	
	15. 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.	15. 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 local 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
	16. 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).	**KARST TOPOGRAPHY** 16, 17. 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). ✓ sequencing ✓ landform analysis
	17. Describes the composition and structure of Earth's materials, including (NM – II.III.II.10): • the major rock types (i.e., sedimentary, igneous, metamorphic) and their function, and • natural resources (e.g., minerals, petroleum) and their formation.	

GRADE 11-12	PERFORMANCE STANDARDS	ILLUSTRATIONS
		✓ realistic representations ✓ effective use of stereoscopic lab techniques
	18. 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).	18. 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 See also Strand I, performance standard # 9. The illustration for performance standards # 3, 4. Strand I also meets standards for this topic.

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, 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). 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). 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 – 16. The student researches a particular technological advance (e.g., 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, 12 – 14. The student examines current news items (e.g., articles, TV, newspapers) on geoethic issues (e.g., environmental consequences of resource extraction). 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). 10. Describes how environmental, economic, and political interests impact resource management and use in New Mexico (NM – III.I.I.13). 11. Describes New Mexico's role in nuclear science (e.g., Manhattan Project WIPP, national laboratories) (NM – III.I.I.14). 12. Identifies how science has produced knowledge that is relevant to individual health and material prosperity (NM – III.I.I.15). 13. 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). 14. 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). 15. 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). 16. 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, 16. **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 too 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.	1 – 3. See Strand II, all topics and Strand III, the 2nd and 3rd illustrations.
	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 I, 1st illustration and Strand II, all topics.
	5. Develops increased competence in using elements of effective writing (APS – LA III.2).	

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, 1st illustration and Strand II, all topics. 9, 10. See Strand II, all topics and Strand III, 2nd illustration. 11, 12. See Strand I, 2nd illustration; Strand II, all topics; and Strand III, 1st illustration.